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Native and Non-Native Intuitions on the Phonology of Binomial Locutions

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Native and Non-Native Intuitions on the Phonology of Binomial Locutions

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Dedication

To my grandmother Klavdia, who is no longer with us and whom we miss dearly.

To my husband and my parents.

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Native and Non-Native Intuitions on the Phonology of Binomial Locutions

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Binomial locutions are a well-known case of structural iconicity that exists in many languages. By binomial locutions I understand formations that have the shape of A conjunction B (1a), or A-B (1b):

(1). a. English: *bread and butter, wear and tear*; French: *dire et juger, aller et retour, ni foi ni loi*

b. English: *wishy-washy, helter-skelter*; French: *pêle-mêle, clopin-clopant, tohu-bohu*

This dissertation deals with phonological patterns in binomial locutions. It will be argued that two kinds of constraints underlie their formation and fossilization of their word order: constraints on the directionality of a certain phonological feature (Birdsong, 1979; Cooper & Ross, 1975) and constraints on the choice of the corresponding segments (Minkova, 2002; Yip, 1988-2000). I refer to the first kind of constraints as to Directionality Constraints and to the second kind of constraints as to Correspondence Constraints. The main objective of this study is to investigate the psychological reality and the relative strength of these constraints in native and non-native speakers of English and French.

This study is experimental and closely models the hypothesis and the methodology set forth in Birdsong (1979). Speakers' sensitivities to the putative constraints are tested with a computer-based judgment task, using pairs of nonsensical expressions, structured in such a way that one expression obeys a specific constraint, and the other expression disobeys it. The task of the participants is to listen to such pairs and to indicate which of them they prefer by using a 6-point scale. The results of this experiment reveal that native English speakers are more sensitive than both native French speakers and non-native English speakers to Directionality Constraints. Moreover, native English speakers prefer rhyming patterns over ablaut alliterating patterns – a trend, that was not observed in other groups tested. Finally, most participants displayed sensitivities to two constraints on directionality – Vowel Quality and Final Consonant Number. I argue that sensitivity to these constraints stems from various factors (iconicity, perceptual salience, short-before-long and unmarked-before-marked principles), which all conspire to favor the same order and predict the same direction of fossilization.

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Chapter 1: Introduction

1. Binomials as a Linguistic Phenomenon

This dissertation deals with phonological patterns in French and English binomials. Binomials are formations that most often have the shape of A conjunction B (*near and dear, trick or treat*) or A-B (*nitty-gritty, helter-skelter*).

1.1. Definition and classification. I adopt the classical definition of binomials given by Malkiel (1959): "the sequence of two words pertaining to the same form-class, placed on an identical level of syntactic hierarchy, and ordinarily connected by some kind of lexical link" (p.113). In previous studies different names have been used to label this phenomenon. Binomial locutions have also been referred to as freezes, irreversible binomials, binomial pairs, coordinated pairs, and even Siamese twins. I will refer to them as binomials or binomial locutions; nevertheless, I acknowledge that this term is not an ideal one. Although traditionally associated with the notion of duality, the number of constituents is not always equal to two (e.g., *person, place, or thing*), and furthermore, the constituents are not always nouns, as the term "binomial" implies. Syntactic equality of the constituents is the most essential trait of binomial locutions.[1] It is crucial to stay away from the confusion of binomials and compounds with a fixed head and a modifier, such as *bedspread, brain drain* and *hobby bobby.* Such structures are not binomials and will not be studied here.

[1] Binomials in which the constituents do not belong to the same grammatical class are rare, for example *by and large*.

Binomials are present in all or most world languages, but their occurrence in different languages is unequal. In English, for instance, they are relatively frequent; many of them show a variety of phonological patterns that will be described in detail in this study. French, at least impressionistically, seems to have fewer binomials and less systematic phonological patterns in their structure. In (1) I list a few examples from both languages.

(1). a. English: *nuts and bolts, short and sweet, salt and pepper, spic and span, cat and mouse, love and leave, above and beyond, razzle-dazzle, wishy-washy, hanky-panky*

b. French: *par monts et par vaux*, *ni peu ni prou*, *ni feu ni lieu, sans tambour ni trompette, ni foi ni loi, bique et bouc, méli-mélo, charivari, tohu-bohu*

Binomials could belong to two major classes – the conjoined class and the reduplicative class (Birdsong, 1979). Note that the last three expressions in (1) a. and (1) b. do not have a conjunction or a preposition between the two constituents, while all the others do. These last three expressions exemplify the reduplicative class, and the rest represent the conjoined class. This division is important, since not all linguists would consider reduplicative subgroup "true" binomials. Malkiel (1959) considers reduplicative and conjoined binomials to have drastically different historical origins. Thus, a "true" binomial originates from the "gradual rapprochement of two independent words" (p.141), which later leads to the merger of the two words into a single unit. By contrast, playful compounds like *pitter-patter* have, according to Malkiel, a single starting form, to which the second form is suffixed or prefixed, "in harmony with preexisting vocalic schema" (p.141). For the purposes of this research, I will examine reduplicative and conjoined classes together, under the same name of binomials, since my interest is grounded in their phonological patterns, which could be the same or similar for both classes (Cooper & Ross, 1975). It will be shown later that speakers have similar intuitions on the acoustical shape of binomials, regardless of whether they are coordinated by a conjunction or used as a reduplicative compound.

1.2. Binomials and their word order. This dissertation is mostly focused on irreversible binomials, whose word order is fixed, such as in examples given in (1). However, not all binomials are irreversible, and in fact, reversibility of binomials is an interesting and legitimate subject of study. Binomials could be fully reversible, irreversible (frozen), or speakers may prefer one order over another to a certain degree (Mollin, 2014). For fully reversible English binomials (e.g., *night and day, short or long*) speakers could produce both orders *A and B* and *B and A*. In contrast, for the irreversible binomials only one order is possible. The critical question is: why did the order of the constituents fossilized in this particular way? Why do we say *nuts and bolts* and not **bolts and nuts*?

This question has been researched previously in the work of Benor and Levy (2006), Birdsong (1979), Bolinger (1962), Cooper and Ross (1975), Fenk-Oczlon (1985), Malkiel (1959), Mollin (2014), Sobkowiak (1993), and many others. The order of the constituents has been argued to be non-arbitrary, motivated by certain factors (constraints), such as semantic, phonological, and frequency factors. Several of these constraints may be simultaneously active for a given word pairing and favor the same linear order. *Wear and tear* is an example of a binomial where two or more constraints may have contributed to its lexicalization: semantics on one hand (wearing precedes tearing), phonology on the other hand (the first constituent starts with a more sonorous consonant than the second one). When multiple constraints conspire to favor the same linear order, this order may have a greater chance to fossilize. In the opposite case, the order may still stabilize, because one of the constraints may be more powerful than others. The relative strength of constraints has been investigated in several corpus studies, which seem to converge on the same conclusion: semantic constraints are the strongest, followed by phonological prosodic constraints, the frequency (of the constituents) constraint, and finally, phonological segmental constraints (Benor & Levy, 2006; Mollin, 2014).

The fact that semantic constraints prevail over all other constraints is not surprising. Human communication is mostly about meaning, not form. However, it would be incorrect to assume that humans are completely insensitive to the acoustical shape of various linguistic structures; numerous studies have shown otherwise (Birdsong, 1979; Bolinger,1962; Wright, Hay, & Bent, 2005 among many others). This dissertation will also demonstrate that speakers exhibit a certain level of sensitivities to the phonological shape of binomial locutions.

1.3. Binomials as formulas. Language has its creative side and its formulaic side. Much research in linguistics has been focused on the former, on spontaneously created, unique sentences and expressions. By contrast, non-propositional or formulaic language – collocations, idioms, proverbs, sayings, clichés – have received less attention from linguists who oftentimes dismiss such structures as uncreative, overlearned, and therefore, uninteresting to study. This view is not shared by everyone; many scholars have recognized the importance of non-propositional language for everyday communication (Ellis, 1996; Wood, 2002; Wray, 1999). Ellis (1996) has taken a particularly strong position on the issue, arguing that “speaking natively is speaking idiomatically using frequent and familiar collocations…” (p.97). Indeed, formulas are ubiquitous in speech and writing and seem to constitute an integral part of native fluency. To this point Bolinger (1976) has argued that “our language does not expect us to build everything starting from limber, nails, and blueprint, but provides us with an incredibly large number of prefabs” (as cited in Wray, 1999, p. 213). Van Lanker Sidtis (2004) has proposed that both propositional and non-propositional use of language constitute fully legitimate, but different kinds of human linguistic behavior.

Binomials belong to the realm of formulaic language. They are similar to idioms and collocations: although they usually contain two or more words, they may be processed and retrieved as one chunk (Arcara, Mondini, Mazzaro, Jerema, & Semenza, 2011). Wray (1999) has argued that fixedness and semantic non-compositionality are two variables that are useful for understanding formulaic sequences. It appears that binomials’ position among other prefabricated units is quite unique, because their meaning can be non-compositional, yet it does not have to be, their order may be fixed, yet it does not have to be. For example, in *nuts and bolts* the meaning of the whole expression is not equal to the meaning of its individual parts, but for other binomials, like *head and shoulders, knife and fork,* the composite meaning is equivalent to the sum of the constituents. Similarly, although the order in *sink or swim* is fixed, the order in *day and night* is reversible. Thus, both in terms of their fixedness and the non-compositionality of their meaning, binomials do not always exhibit the typical features of formulaic sequences.

1.4. Binomials and their phonology. One of the most intriguing aspects of binomial locutions is their phonological structure; rhyme, alliteration, the use of contrasting vowels, and other "catchy" expressive features have been and continue being researched and debated in linguistic literature. Phonology in binomials may be the root of their cohesiveness and memorability; or, as Southern (2000) beautifully said about binomials: "Their semantic and categorical joints are lubricated by internal phonetic association" (p. 256). My goal is to investigate the putative phonological rules that motivate the word order and the structure of binomials in two languages, French and English.

Expressivity in human languages can come in a lot of different shapes. Puns, poetry, and nursery rhymes are all part of expressive, playful language; their existence testifies of our inclination to be creative with words and sounds. The importance of the form in human communication can be seen in the widespread use and productivity of binomial and multinomial pairs. Speakers of all languages often use binomials, both existing and novel, in a variety of cultural contexts and genres. For example, businesses and artists alike are fond of using rhyme, assonance, alliteration, vowel alternation, complete or partial reduplication, and other relevant linguistic phenomena in the titles of their works, company names, and advertisement slogans. Binomials and multinomials often have these memorable and aesthetically pleasing features, therefore, they are used in business and art, as illustrated in (2):

(2). a. English: *Sweet & Sassy* (salon and spa for kids); *Wet & Wild* (cosmetics brand); *Mane & Tail* (shampoo brand); *Guns & Roses* (name of a music band); *Grip & Grab (*brand of a reaching aid); *Shake & Bake* (brand of bread crumbs); *Cops & Robbers* (title of a feature film and a children's game); *Shake & Wake* (brand of a vibrating alarm clock); *Feed & Wax* (brand of wood polish); *Crunch & Munch* (brand of popcorn); *Quick & Brite* (brand of a cleaning paste); *Cut & Slice* (brand of cutting boards); *Wear & Flair* (an apparel brand); *Head & Shoulders* (shampoo brand); *Bed Bath &Beyond* (chain store); *Chip & Dale* (title of a cartoon)

b. French: C*ric-crac-croc* (brand of cereal); *Du pain, du vin et du Boursin* (a slogan from a commercial); *Dubo, Dubon, Dubonnet* (a slogan from a commercial); *Ni clou ni vis* (brand of a glue); *Sans toit ni loi* (title of a feature film); *Le rouge et le noir* (title of a novel); *Le coq et le Renard* (title of a fable); *Sans pitié ni pardon* (title of a feature film); *Sans nom ni blason* (title of a children's book); *Ni putes ni soumises* (name of a French feminist group); *Sans armes, ni haine, ni violence* (title of a feature film); *Sans pudeur ni morale* (title of a feature film); *Toupie et Binou* (Canadian animated series); *Astérix et Obélix contre César* (title of a feature film)

Both semantics, phonology, and other factors may motivate the word order in the examples above. I will return to these examples later with a more detailed explanation;

for now, I will simply note that phonological rules posited by Cooper and Ross (1975) may be relevant for binomials given in (2).

1.5. The rationale for studying expressive language. From the inception of the present study my interest has been grounded in the esthetic dimension of language, which is particularly salient in poetry, verbal art, nursery rhymes, folktales, riddles, proverbs, etc. The universal nature of such phenomena may be the best proof that as humans, we have a need to use language for esthetic purposes and that in certain genres, the form of expression is at least as important as the meaning. Since most of linguistic research has been focused on propositional language, little is known about expressive language, about what it means to use language expressively, and what sound patterns are perceived as playful, artful, and acoustically pleasing by native speakers of a particular language. It is crucial to address this gap in knowledge; since poetry and verbal art are universal phenomena, using language for esthetic purposes is common to all human societies and constitutes an integral part of being human. Binomials exhibit phonological features that are similar to poetry and verbal art; studies on their phonology (Birdsong, 1979; Cooper & Ross, 1975; Minkova, 2002) tend to agree on a certain naturalness and "right-soundness" of their acoustic shape. Previous psycholinguistic experiments (Birdsong, 1979; Bolinger 1962) have confirmed that speakers indeed tend to have preferences when comparing two nonce or novel binomial expressions: some sound templates are judged as more natural than others. Thus, studying binomials seem to be an appropriate way of investigating expressive language in general with the purpose of determining what particular phonological patterns are associated with expressiveness.

The universality of poetry and verbal art is one of the reason why it is important to investigate expressive language. Crucially, expressive sound patterns may differ crosslinguistically, since they may be constrained by general properties of a particular language. Metrical structure, prosody, as well as other features of a language may have a restraining effect on what is possible and probable in the expressive domain of this language. Some studies have shown, for example, that French and English native speakers have different opinions on identical rhymes (right/write): in French such rhymes are considered artistic, while in English they seem to be judged as unsatisfactory (Wagner & McCurdy, 2010). Wagner and McCurdy (2010) attributed this difference to the differences between English and French information structure, which is a general property of a language. Since expressive patterns could vary crosslinguistically, native and non-native speakers might have quite different judgments on their acoustic attractiveness. Studies in SLA that are focused on expressive language are scarce; thus, another reason for studying expressive language resides in the need to understand if expressive sound patterns are learnable by non-native speakers, and how the native language of L2 learners affects their judgments of expressive patterns in their L2. A deeper understanding of crosslinguistic differences in expressive language can potentially be applicable in translation studies, particularly in literary translation of poetry and prose, where the esthetic dimension plays a critical role.

1.6. The structure of this dissertation. As already mentioned, this dissertation is focused on the phonology of binomials. The main goal of it is the investigation of intuitions on the most felicitous phonological patterns in binomials for both native and non-native speakers of French and English.

This dissertation is organized as follows. Chapter 2 offers a review of literature. In this chapter I focus on two main sources: a. research that is centered around Directionality Constraints – these are phonological segmental constraints on the word order in binomials, which were described in the seminal paper of Cooper and Ross (1975) and later further investigated by other researchers (Benor & Levy, 2006; Birdsong, 1979; Mollin, 2014); b. research that is centered around Correspondence Constraints on reduplication, discussed largely in Optimality-theoretic work (McCarthy & Prince, 1994; Minkova, 2002; Yip, 1998). I use both of these sources to construct my hypotheses and to frame my research questions, which are described in the following chapter. In chapter 3 I explain the rationale for this study, the research questions, and the methodology that was used to find the answers to the research questions. Chapter 4 presents the quantitative results and offers a discussion of Directionality Constraints, while chapter 5 presents the quantitative results and offers a discussion of Correspondence Constraints. In chapter 6 I compare the performance of native and non-native speakers and elaborate on the differences between them. Finally, the overall conclusions of this experimental study and the future avenues of research are presented in chapter 7.

Chapter 2: A Review of the Background Literature

2. The Multiplicity of Rules on the Word Order of Binomials

Several kinds of constraints may motivate the order of the constituents in a binomial locution. In this section I briefly describe the constraints that I will NOT be examining in this study, such as semantic constraints, frequency constraints, phonological prosodic constraints, pragmatic constraints, and alphabetic order. All of these rules are interesting to examine. However, this dissertation is mainly focused on segmental phonology of binomials, therefore, the discussion of all other constraints will be quite concise.

2.1. Semantic constraints. In the large group of semantic constraints, structural iconicity, me-first principle, formal markedness, and other constraints have been identified. <u>Structural iconicity</u> manifests itself to a large extent in diagrammaticity, which means that the linguistic structure of an utterance mirrors the structure of the content it conveys. For example, both *drink and drive* and *hit and run* are motivated by a structural iconicity constraint, because drinking precedes driving and hitting precedes running. Another powerful semantic constraint is often referred to as <u>me-first principle</u> (Cooper & Ross, 1975). This principle states that the first constituent tends to be either more central to the society, or more applicable to a prototypical speaker of a language. Features like *here, now, present generation, adult, male*, *positive, singular* have been traditionally associated with a prototypical speaker. Therefore, binomials like *men and women, man and machine*, *now and then* are sequenced in accordance with this principle. <u>Formal markedness</u> is believed to affect the word order when a more general item (less formally marked) occurs in the first position, and a more specific item (more formally marked) is mentioned second. Examples include *flowers and roses, sewing and quilting, complete and unabridged* (Benor & Levy, 2006). There are other constraints that are semantic in nature, but describing them is beyond the scope of this study. Among the examples given in (2) binomials that seem to have a strong semantic motivation are: *Grip & Grab, Shake & Bake, Shake & Wake*.

2.2. Frequency constraint. The frequency constraint predicts that the item in the first position is likely to be more frequent than the item in the second position. Examples in (2) that seem to obey the frequency constraint are: *Wear & Flair, Sans nom ni blazon (no name or emblem)*[2]. Fenk-Oczlon (1989) examined the frequency constraint in detail. In her sample 84% of binomials obeyed this constraint, which was a higher proportion than for any other constraint. To this point Benor and Levy (2006) mention the psychological phenomenon of latency, the fact that more frequent words are generally more easily retrievable from the mental lexicon and therefore, more readily available for production than less frequent words. Indeed, in her later work Fenk-Oczlon (2001, p. 433) argued that frequency goes hand in hand with cognitive ease, familiarity, simplicity of form, and prototypicality: “Obviously frequency and familiarity are central factors of cognitive performance”. The researcher substantiates her claims with several facts. First of all, she shows that frequency is an important factor in phonetic reduction. In both casual and careful speech only highly frequent words tend to be reduced with

[2] My translation

consistency. This reflects the relative ease with which speakers process high frequency words. By contrast, low frequency words tend to be more difficult to process on line, therefore, speakers tend to enunciate them with more care to prevent comprehension issues and to lessen the cognitive load. Secondly, various brain-imaging studies have revealed that low frequency words yield a larger N400 component than high frequency words. N400 component is associated with an unfamiliar, non-prototypical and otherwise illogical or deviant signal. Words that elicit large N400 component are not only infrequent, but also tend to be more poorly memorized (Neville, Kuas, Chesney, & Schmidt, 1986; Smith & Hallgren, 1987). The frequency constraint on the order of constituents in binomials has been shown to be relatively powerful in several other studies. According to Benor and Levy's (2006) study, the frequency constraint is weaker than semantic and prosodic constraints, however, it outranks phonological segmental constraints.

2.3. Phonological prosodic (metrical) constraints. This group of constraints include Panini's law, avoidance of lapse (two or more weak syllables in a row), and avoidance of ultimate stress in the second constituent. Panini's law has to do with the number of syllables. Specifically, the second element of a binomial is likely to have more syllables than the first one. Examples in (2) that are sequenced in agreement with this constraint are: S*weet & Sassy, Head & Shoulders, Du pain, du vin et du Boursin*. As for two other prosodic constraints, avoidance of lapse and avoidance of ultimate stress in the second constituent, their relevance for English has received some support from previous studies as well (Bolinger, 1962; McDonald, Bock, & Kelly, 1993). It is important to highlight that these two constraints would only be relevant for a language like English, which prefers alternating beats, organized into a trochaic foot structure (Selkirk, 1984).

2.4. Pragmatic constraints. This group of constraints is applicable in cases when the order of the two elements has not fossilized. Different sociolinguistic factors can play a role in determining a particular order for a specific context. One of the recent sociolinguistic studies by Iliev and Smirnova (2014) tested the hypothesis that the word order in reversible binomials may be associated with various psychological and demographic variables. They examined how pairings like *Republicans and Democrats, Christians and Muslims, Honda and Toyota, Obama and McCain* are sequenced, depending on the website or the Internet forum where they are mentioned. Not surprisingly, the researchers found a reliable positive correlation between the general orientation of the website and the number of occurrences of the pairings, where the item that represents this orientation is placed in the first slot. Thus, conservative websites tend to have *Republicans* and *McCain* in the first place, while liberal websites tend to exhibit the opposite pattern.

2.5. Alphabetic order. A limited number of binomials may be motivated by the alphabetic order constraint: the first constituent is predicted to start with a letter that occurs first in the alphabet (Sullivan, Casagrande, & Belyayeva, 1995). This constraint may be more relevant in contexts with two proper names. Thus, in (2) *Astérix et Obélix* are sequenced in the alphabetic order, although semantic constraints may also be relevant here, since Astérix is the principal character of the story. In business it is often the case that a company title is composed of the names of two (or more) founders, and the alphabetic order may be the main motivation for ordering them, even if it leads to the violation of phonological constraints (e.g., *Abercrombie & Fitch*).

2.6. Phonological segmental constraints. Now I turn to the group of constraints that constitute the primary focus of this study. Some of these constraints have been first described in Cooper and Ross' paper "World Order" (1975). These constraints are arguably the least well researched and rather poorly understood, especially from a crosslinguistic prospective. In (3) I have listed the constraints that will be investigated in this dissertation:

(3). **Initial consonant number (ICN):** the 1st element has fewer initial consonants compared to the 2nd (e.g., *harum-scarum*).

Initial Sonority (IS): the 1st element has a more sonorous initial consonant compared to the 2nd (e.g., *wear and tear*).

Vowel Quality (VQ): the 1st element has a fronter and higher stressed vowel compared to the 2nd (e.g., *pitter-patter*). In (2) *Cric-crac-croc* seems to be sequenced in accordance with VQ.

Vowel Length (VL) for English: the 1st element has a shorter stressed vowel compared to the 2nd (e.g., *trick or treat*). In (2) *Wet & Wild* seems to obey this constraint.

Vowel Nasality (VN) for French: the 1st element has a stressed oral vowel, while the 2nd element has a stressed nasal vowel (e.g., *pieds et poings liés*)

Final Consonant Number (FCN): the 1st element has fewer final consonants compared to the 2nd (e.g., *leaps and bounds*)

Final Sonority (FS): the 1st element has a less sonorous final consonant compared to the 2nd (e.g., *rock-and-roll*). In (2) *Mane & Tail* obeys this constraint, although semantic factors may also be relevant.

All the constraints specified in (3) are putative constraints on **the directionality of a certain feature.** From now on, I will refer to them as to **Directionality Constraints (DC).** For example, IS predicts that the constituent in the first slot will begin with a more sonorous consonant than the one in the second slot. In other words, the sonority of the initial segment is hypothesized to decrease from left to right. This is an important point, because in sections 2.7. and 2.8. I will also describe a different kind of constraints, **Correspondence Constraints.**

With respect to DC, I will first consider the constraints on initial segments, i.e. onsets. At least for English, they have been generally described in terms of the number of initial consonants and the quality of initial consonants (obstruency / sonority).

2.6.1. Initial Consonant Number (ICN). The Initial Consonant Number (ICN) constraint predicts that the second item is likely to have more initial consonants than the first one. A few examples are listed in (4):

(4). a. English: *helter-skelter, fair and square, harum-scarum, by hook and by crook*

b. *French: rogne et grogne*

Note that in French I was able to find only one example, while in English examples are numerous. I will assume for now that this constraint is English-specific. Benor and Levy (2006) tested ICN in their corpus study. Even though it is extremely hard to get a sense of the directionality of phonological constraints from a corpus study due to the interference of semantics and other factors these researchers concluded, that their data seem to provide a very modest support for this constraint. Wright et al. (2005) initially disagreed with the directionality of this constraint. They hypothesized that initial clusters will most likely be disfavored in the second position, because a cluster in the second position would result in an even longer sequence of consonants, due to the fact that it would immediately follow *'and'* (which is likely to be reduced to [n]). In addition, they appealed to the studies on edge effects (Lehiste, 1960-1961; Byrd, 1994) and argued that onset is a strong position for a prototypical English word. Therefore, this position would be more appropriate for consonant clusters which require a greater articulatory effort. "At the word level it has been shown that in monosyllabic CVC words the initial consonant tends to be longer and have a greater articulatory magnitude" (Wright et al., p. 535). However, in their experiment, where first names were used as stimuli, they did not find support for their hypothesis. For instance, a pair of names like *Stella and Tessa* was judged equally natural in the predicted order as in the reversed order. This constraint needs further testing with nonce words, because first names are not minimal pairs[3], and although researchers typically control for frequency and gender, other confounds (affective or phonological) may interfere with subjects' intuitions.

2.6.2. Initial Sonority (IS). With respect to Initial Sonority (IS), Cooper and Ross (1975) argued that in English the initial segment of the first constituent is likely to be more sonorant, while the initial segment of the second constituent tends to be more

[3] Some names could be minimally different, i.e., *Nicky and Vicky*.

obstruent. A few examples for English are listed in (5) a. In (5) b. I listed French binomials, where the onsets of the two constituents are different in quality. However, it is unclear if French has a systematic directionality pattern, since a small number of French binomials is insufficient to make any predictions.

(5). a. English: *roly poly, wheel and deal, namby-pamby, super-duper, wear and tear, razzle-dazzle, hanky-panky*

b. French: *pêle-mêle, ni foi ni loi, ni feu ni lieu, tohu-bohu, charivari, faire mallette et paquette à qqn*

Wright et al. (2005) investigated this constraint with English first names and found a weak preference for sonorant-initial names in the first position. Birdsong (1979) also provided experimental evidence that native speakers of English prefer a more obstruent consonant in the second slot, while native speakers of French seem to be on average insensitive to this constraint. However, it is worth noting that the French respondents had a mild preference for the opposite order, with a more sonorant onset in the second slot.

I now turn to the constraints on nuclei and codas. They are purposefully examined together, because both nuclei and codas are important for determining the weight of syllables.

2.6.3. Vowel Length (VL). Let us consider Vowel Length (VL). According to this constraint, long stressed vowels would be preferred in the second constituent. By long vowels I mean either a tense vowel, or a diphthong. Specifically, short vowels are æ, ɛ, I, ʌ, ʊ, and long vowels are all other English vowels. Some of the naturally occurring binomials in English that seem to obey this constraint are listed in (6).

(6). *trick or treat*[4]*, rant and rave, wax and wane, stress and strain, hill and dale*

As we can see, these examples are not minimal pairs; not only the duration of the vowel distinguishes the two elements in such locutions, but other factors may play a role as well (for instance, final or initial sonority, or simultaneous changes in the vowel quality). It is indeed hard to find expressions that are minimal pairs in natural languages, therefore, it is hard to disentangle vowel duration from vowel quality in cases like *hill and dale*. In Birdsong's study (1979) both native speakers of English and native speakers of French were mildly sensitive to VL, although native English speakers exhibited a higher level of sensitivity, possibly because English tends to be more weight and length sensitive than French (Ramus, Nespor, & Mehler, 1999). Birdsong tested sensitivities to English vowel length with pairs like *grib and greeb*. In English there are no vowels that differ strictly in length, which makes the testing of VL somewhat problematic. Although the differences between /I/ and /i/ or /ʊ/ and /u/ are not limited to duration, but also include qualitative vocalic differences, using pairs like *grib and greeb* seems to be an acceptable way of testing VL, because it allows to separate phonological length from quality to the extent that it is possible in English. Indeed, some studies show that F1, F2 and F3 measurements for /I/ and /i/ or /ʊ/ and /u/ are relatively close for these pairs of vowels (Peterson & Barney, 1952), which points to similarity in their qualitative features.

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[4] *Trick or treat* is considered to be an interesting case where the fossilized word order is at odds with semantic constraints which require a positive item (*treat*) to be used in the first slot.

2.6.4. Vowel Quality (VQ). According to the VQ constraint, high front vowels are preferred in the first slot, while vowels that are backer and lower are preferred in the second slot. The following examples for French and English illustrate this trend:

(7). a. English, height: *dilly-dally, riff-raff, zigzag, mishmash*

b. French, height: *des cliques et des claques, prêchi-prêcha, comme ci comme ça*

c. English, advancement: *beck and call, bill and coo, by guess and by gosh*

d. French, advancement: *bique et bouc*

Experimental evidence confirms that both English and French speakers are sensitive to VQ (Birdsong, 1979). Vowel quality interacts with length: in *dilly-dally*, for instance, not only are the two main vowels opposed to each other in height, they are also opposed to each other in **phonetic** duration, /I/ being phonetically short and /æ/ being phonetically long. Naturally, it becomes difficult to argue which factor (phonetic duration or quality) motivates the order in such cases. To this point, Minkova (2002) has argued that there may be a tendency to prefer phonetically long segments in word- and phrase-final syllables.

2.6.5. Final Consonant Number (FCN). The constraint Final Consonant Number (FCN) predicts that the second element is likely to have more final consonants. Originally, Cooper and Ross' definition of this constraint was the opposite: based on examples like *betwixt and between, wax and wane,* they hypothesized that the first element is likely to have more final consonants. However, this hypothesis was disconfirmed by experimental evidence. Birdsong (1979) found, that native speakers of English and French, as well as learners of English (native speakers of different languages) prefer the number of final consonants to be greater in the second constituent, although this trend failed to reach statistical significance. In his later article entitled “The sound of meaning” (1982) Ross acknowledged that the directionality of this constraint should be formulated in the opposite way.

2.6.6. Final Sonority (FS). The next phonological constraint is Final Sonority (FS): it predicts, that the word with a more obstruent final segment is likely to occupy the first slot. This constraint was tested in Wright et al.'s (2005) experiment with first names. The results showed that subjects indeed tend to prefer a more obstruent coda in the first constituent. Interestingly, Lohmann (2012) examined both reversible and irreversible binomials in a corpus study and found that final segment sonority was a significant factor for the set of irreversible binomials, but not for the set of reversible ad hoc ones. A few examples for this constraint for English are listed below. I was not able to find any examples in French.

(8). *rock-and-roll, kith and kin, push and pull, safe and sane*

2.6.7. Vowel Nasality (VN). It has been pointed out before, that in contrast to English, French tends to have very few phonological patterns in binomial locutions. VQ may be an existing constraint on directionality in French (see examples in (7) b. and (7) d.). Also, French has binomials in which the two constituents differ in the quality of the initial consonants, although the directionality pattern is unclear (see examples in (5) b.). Very few linguists have investigated binomial locutions in French, especially from the phonological standpoint. In one relevant study, Couasnon (2012) examined the phonology of reversible expressions coordinated by the conjunction *et* and consisting of two first names. This researcher was careful to control for gender and frequency factors. In addition to syllable number (Panini's law), three other phonological factors were identified as potentially important in French: 1. syllable openness (based on the principle of the maximization of onsets): the first constituent is more likely to have a coda than the second one; 2. quality of the coda: the first element's coda is likely to be a stop (oral or nasal) and unlikely to be a glide or a liquid; 3. vowel nasality: if one of the elements ends in a nasal vowel, it is likely to be placed in the second slot. This last putative constraint is tested in the present study.

Couasnon found that only about 14% of those names that end in a nasal vowel occur in the first position in her corpus. She compared it with the names that end in an oral vowel, and found 62.2% of them in the first position. This leads to the following interesting prediction: if there was a locution with two constituents, which differed only in the nasality of the last vowel, the constituent with an oral vowel would be preferred in the first slot, and the constituent with a nasal vowel in the second. If coordinated by *et*, both orders would result in a hiatus, which is suboptimal. I have not been able to find many real binomials in French that would confirm Couasnon's hypothesis. In (9) a. I listed examples where the predicted order is observed, and in (9) b. examples that have the opposite order, although, as a reminder, phonological constraints may not be very powerful in real binomials:

(9). *a. de tout et de rien, pieds et poings (liés), bel et bien*

b. cahin-caha, chien et loup, sang et eau, vison-visu

The lack of naturally occurring French binomials which would exemplify the putative VN constraint suggests that French speakers may not be sensitive to it. However, I consider Couasnon's finding intriguing, because nasal vowels are not only universally more marked compared to oral vowels, they also tend to be longer. Féry (2003) pointed out that French nasal vowels are intrinsically bimoraic, and furthermore, that they undergo lengthening, when followed by any final consonant. If French speakers are sensitive to either length or markedness of nasality, they may have directionality preferences for VN. One principle that has been used in previous studies (Birdsong, 1979; Lohmann, 2012) to explicate the English directionality patterns in binomials is the short-before-long principle: it predicts that a shorter constituent will precede the longer one (length is measured as the number of syllables, vocalic duration, or the number of initial /final consonantal segments). The short-before-long pattern has been observed in English binomials with putative constraints like VL and FCN; it would not be unreasonable to hypothesize that in other languages the short-before-long pattern may be present to some extent and that VN could exemplify this principle in French. To my knowledge, VN in French has not been tested yet, which serves as an additional reason to include it in the present study.

2.6.8. Summary. Summarizing, in section 2.6. I have described current research findings on the phonological segmental constraints, listed in (3); these are all putative <u>constraints on directionality</u> to which speakers may be sensitive. These constraints have been first formulated by Cooper and Ross (1975) for English; the extent to which these constraints may be relevant for other languages remain poorly understood. Some of these constraints have been tested before, while others have not. Overall, our understanding of speakers' preferences on the phonology of binomials, especially from a crosslinguistic prospective, is still not sufficiently clear.

2.7. Reduplication in Optimality Theory. In this part I will review the Optimality theoretic work on reduplication in English. I have adopted the classification of binomials, according to which there are two types of binomials, reduplicative and conjoined. Naturally, reduplication as a linguistic phenomenon is more relevant for the reduplicative binomials than for the conjoined ones, although it is worth noting once again that similar phonological patterns are attested in both types. For example, both reduplicative and conjoined binomials exhibit alternations of stressed vowels (e.g., *pitter-patter, wishy-washy, spic and span*, *hem and haw*) and initial consonants (e.g., *hanky-panky, loosey-goosey*, *wheel and deal, wear and tear*). Recall that Malkiel (1959) pointed out that in the process of formation of reduplicative binomials there is a single starting point, a single term, to which an affix is added. By contrast, conjoined binomials have two starting points – two words present in the lexicon. This suggests, that there is an important difference in the underlying representation for the two categories of binomials. For a novel or fully reversible <u>conjoined</u> binomial the underlying representation suggested by Benor and Levy (2006) is {A, B}, where A and B are two independent terms, fully specified phonologically, although the order of A and B is not specified. Depending on the strength and activity of various constraints, speakers can produce either *A and B* or *B and A.* A certain order may fossilize so that A and B are no longer independent from each other, but form a single lexicalized unit, such as *cat and mouse*, or *nuts and bolts*. With respect to reduplicative binomials, the process of their formation is hypothesized to be quite different; this process will be explained in detail in the following section.

2.7.1. Correspondence Theory: General tenets. Reduplication was particularly well researched in theoretical work of McCarthy and Prince (1994), Minkova (2002), and Yip (1998-2000). According to the Correspondence Theory (McCarthy & Prince, 1994), the underlying representation of a reduplicative word consists of a stem and a phonologically empty $\text{Affix}_{\text{RED}}$. On the output-level, the correspondent of the stem is the base, and the correspondent of the $\text{Affix}_{\text{RED}}$ is the reduplicant. There are three bidirectional relations in this model: Input-Output Faithfulness, Base-Reduplicant Identity (Output to Output Matching), and Input-Reduplicant Faithfulness. As Minkova has pointed out, "matching of the input to the output (IO) and that of the output base to the reduplicant (BR) is captured by the notion of correspondence" (2002, p.135). This is why I will refer to the constraints discussed in this chapter as to Correspondence Constraints (CC).

It has been claimed that Input-Reduplicant Faithfulness is a subsidiary relation, because, as Ananian puts it, "faithfulness on the stem always dominates faithfulness on the affixal domain" (2001, p. 3). In a simplified model, given in the diagram in Figure 1, the Input-Reduplicant Faithfulness relation is not shown, because of its non-essential status. The other two relations are illustrated with the bidirectional arrows.

The BR identity relations include the same family of constraints as the IO Faithfulness relations, such as MAX, DEP, and IDENT. However, in the hierarchy

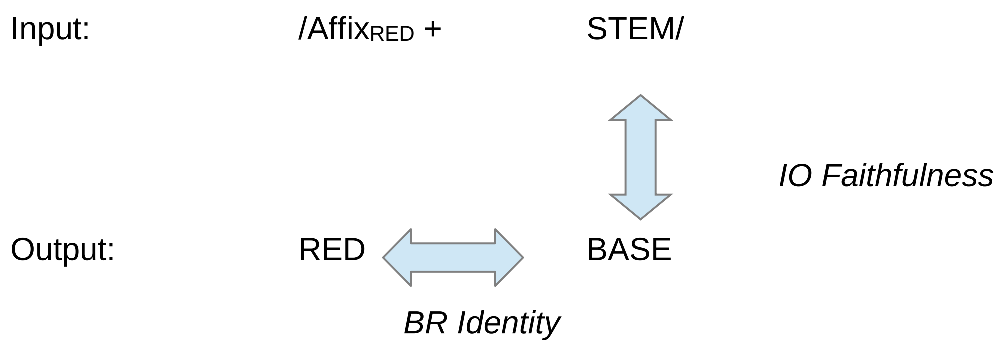

Figure 1. A Simplified Model of Base-Reduplicant (BR) Correspondence.

proposed by McCarthy and Prince, the B-R Identity is dominated by certain phonological markedness constraints, such as, for example, NO CODA or *COMPEX ONSET. The hypothesis is that the unmarked structure will emerge in the reduplicant, although it is in not required in the base. The emergence of the unmarked in the reduplicant is possible due to the following simplified constraint ranking (Yip, 2000):

(10). FAITH-IO>> MARKEDNESS>> FAITH-BR

This constraint ranking insures that the marked structure is blocked in the reduplicant, while it is not blocked in the base, because FAITH-IO is the strongest constraint that requires the base to be faithful to the input. The fact that FAITH-BR is weaker than MARKEDNESS means that the reduplicant may not be an exact copy of the base and will most likely emerge, under the pressure of MARKEDNESS, with unmarked segments, as an “improved” version of the base.

2.7.2. Rhyme and alliteration. Some researchers have objected to the view that the formation of a reduplicative word involves a stem and an affix; rather, reduplication has been argued to be a process driven by phonology, with two constituents being morphologically equal. For instance, Yip (1998-2000) has argued that the presence of the underlying phonologically empty $\text{Affix}_{\text{RED}}$ is unnecessary, since the motivation for a reduplicative process is to create sequences that rhyme and alliterate, rather than to realize some abstract affix. An important concept in Yip's early work (1998) is <u>identity avoidance</u>. Two conflicting constraints – REPEAT and *REPEAT (also referred to as *ECHO) – are hypothesized to be present in world languages, explaining why some instances of reduplication are complete reduplication (e.g., *boo-boo*) and others are partial reduplication (e.g., *pow-wow*). The constraint *REPEAT militates against complete reduplication and forces identity avoidance. REPEAT is low ranked, and consists of two constraints: RHYME and ALLITERATE. A case of an exact copying, such as in *boo-boo* or *goody-goody* would comply with both RHYME and ALLITERATE, which are formulated as follows:

(11). ALLITERATE: The output must contain at least one pair of adjacent syllables with identical onsets.

RHYME: The output must contain at least one pair of adjacent syllables with identical rhymes.

Note that Yip defined the constraints in terms of adjacent syllables, but the definition can also be generalized to larger prosodic units (feet, stressed syllables).

In her later account of reduplication, Yip (2000) has modified her position by claiming that <u>markedness</u> alone is the driving force of the segmental changes in the reduplicant (and not the *REPEAT constraint as she previously suggested). Indeed, if *REPEAT is the causal factor of the segmental changes, theoretically, if it is highly ranked, it always forces some modification, even if such process results in a reduplicant that is more marked than the base. Following McCarthy and Prince (1994), Yip (2000) suggests that the fixed segments in the reduplicant will show the emergence of the unmarked. Markedness in Yip's view interacts with RHYME and ALLITERATE, which are two constraints that require exact copying of rhymes and onsets respectively. The following example from Yip (2000) illustrates what would happen in a case, where a markedness constraint against labial consonants interacts with MAX I-O, RHYME and ALLITERATE.

Tableau 1. An Example from Yip (2000).

/bui/	MAX I-O	RHYME	*LABIAL	ALLITERATE
☞ a. bui lui			*	*
b. bui bui			**!	
c. lui lui	*!(b)			

In this grammar, candidate c. does not surface, because of the violation of a high-ranked constraint MAX I-O; in candidate b. there is a double violation of the constraint against labial consonants, and only candidate a. has a chance to surface, since the phoneme /b/ is replaced by an unmarked segment, /l/ in the reduplicant. The optimal candidate, *bui lui*, violates * Labial and ALLITERATE, a constraint that is low-ranked compared to RHYME. This example demonstrates that complete reduplication does not surface not because there is a constraint *REPEAT, but rather, because there is a markedness constraint that blocks the exact copying of the base.

RHYME and ALLITERATE are two constraints that seem to apply for both French and English binomials, since many of them have either rhyming or alliterating patterns. For example, *hanky-pank*y has a rhyming pattern, while *flim-flam* and *dilly-dally* exhibit alliteration. The latter two words are also referred to as ablaut reduplicatives, due to a very salient pattern of vowel apophony. Together, words like *ha-ha, hanky-panky,* and *dilly-dally* exemplify three main kinds of reduplication in English (Minkova, 2002):

1. Copy reduplication. Under this category fall all the cases of complete reduplication, such as *goody-goody* in English or *train-train* in French.
2. Rhyme reduplication. Under this category fall the cases of partial reduplication where the onsets of the constituents are different, while their rhymes are identical. Examples include *hanky-panky* or *harum-scarum* in English and *tohu-bohu* and *pêle-mêle* in French.
3. Ablaut reduplication. Under this category fall the cases of partial reduplication where stressed nuclei of the constituents are different, such as *shilly-shally* in English and *prêchi-prêcha* in French.

Copy reduplication is not going to be a focus for this study; on the other hand, rhyme reduplication and ablaut reduplication will be treated here with detail. Ablaut reduplication was particularly well analyzed in the work of Minkova (2002), which I will summarize next.

2.7.3. English ablaut reduplication. Similarly to Yip, Minkova (2002) has emphasized the inappropriateness of such terms as affix and stem for reduplication. She has argued that both parts of a reduplicative compound have an equal morphological status, despite the fact that one or both of them might be actual words. For example, *patter* is a real word while *pitter* is not. Although some researchers would see *patter* as a stem, and *pitter* as a prefix, this position is debatable, since reduplicative compounds may be form-driven, rather than morphology-driven. Minkova adopts exactly this position: there is no hierarchy between the base and the reduplicant, "the two parts are equally 'primitive' partial copies of each other" (p. 138). In support of her argumentation, she quotes Marchand (1969): "It cannot … be denied that the rhythmic doubling and the element of ablaut and rime do in fact constitute a motivation, and that these aesthetic elements determine the character of the combination based on them. … Even those combinations which are composed of two independent words do not speak against the essential character of twin words" (as cited in Minkova, 2002, p.136). Minkova also insists on the role of phonological factors, and analyzes reduplicative words as aesthetic creations, as verbal art products. Phonological and prosodic well-formedness are, according to Minkova, the root of both segmental changes and directionality preferences of the BR relation.

Minkova's analysis of the ablaut reduplication in English can be summarized as follows: the difference in quality between two nuclei in ablaut words is motivated by the constraint INTEREST. Similarly to Yip's (1998) *REPEAT constraint, INTEREST forces a change, but a rather specific one. It favors maximal perceptual distance between the base and the reduplicant, both in terms of vowel height and phonetic vowel duration. Minkova claims that the difference in duration should be maximal, but non-categorical (by a non-categorical change in duration it is meant that phonological length of the vowels should remain the same). The linear ordering of the vowels is motivated by domain-final lengthening: a phonetically long vowel is predicted to occupy the second slot. Thus, the pairing of /I/ and /æ/, where the former precedes the latter, respects INTEREST. Also, to rule out structures like /rIf-rif/, /rʊf-ræf/, and /rIf-rʊf/, Minkova proposes a faithfulness constraint Ident-BR (μ) which militates against differences in moraic content between the base and the reduplicant, and a markedness constraint *Pl/Lab which prohibits the use of labial vowels. The following constraint hierarchy is proposed:

(12). MAX-BR, DEP-BR, IDENT-BR (μ) >> *Pl/Lab, INTEREST>> IDENT-BR (High)

Let us consider how Minkova's account would explain the emergence of /rIf-ræf/ and the non-occurrence of other candidates. Tableau 2 (slightly modified from the original Tableau in Minkova's 2002 article) illustrates that /rIf-ræf/ is the optimal candidate, which violates only one low-ranked constraint, IDENT-BR (High).

The worst candidates in this tableau are /rIf-rif/ which violates Ident-BR (μ) and /rʊf-ræf/ which violates *Pl/ Lab. Minkova points out, that labial vowels are practically unattested in English ablaut words, with a few known exceptions. Candidate e., /ræf-rIf/, violates the constraint on the final length, which requires phonetically longer elements to occupy the second place. This is how Minkova accounts for the directionality pattern in ablaut words. Finally, both candidate c., /rIf-rɛf/, and candidate d., /ræf-ræf/, violate the constraint *Ident-BR (High), only in candidate d., /ræf-ræf/, this violation is fatal, because the two nuclei in this candidate are identical, and the candidate c. has a non-fatal violation, since the two nuclei are different, but not maximally different in height.

Tableau 2. A Slightly Modified Example from Minkova (2002).

/rIf-ræf/	IDENT-BR (μ)	*Pl/Lab	INTEREST: FINAL LENGTH	INTEREST: *Ident-BR (HIGH)	IDENT-BR (HIGH)
☞ a. /rIf-ræf/					**
b. /rIf-rif/	*!				
c. /rIf-rɛf/				*	*
d. /ræf-ræf/				*!	
e. /ræf-rIf/			*!		
f. /rʊf-ræf/		*!			

Minkova's analysis predicts that *Ident-BR (High) would make structures like /rIf-ræf/ the most felicitous, while structures like /rIf-rʌf/ and /rIf-rɛf/ would be marginally allowed. Ablaut formations that contain labial vowels or vowels that are different in moraic composition would be prohibited. With regard to words like *hip-hop* and *flip-flop* Minkova notes, that the tenseness / laxedness status of the second vowel in such words is ambiguous. Classified as tense, /ɑ/ is underlyingly bimoraic, and therefore, it would be predicted to be prohibited in ablaut reduplication, based on Minkova's analysis. Minkova (2002) acknowledges that vowels /ɔ, ɑ/ “push the threshold of acceptability with respect to the faithfulness constraint Ident-BR (μ) to the limit” (p. 158), but claims that at the time when the majority of ablaut words like *flip-flop* penetrated the English lexicon, the quality of the second vowel was different from its modern counterpart (specifically, it was lower and more open).

2.8. Directionality and Correspondence in the present study. I have identified two separate kinds of relevant sources of background literature: those that treated Directionality Constraints (DC) and those that investigated reduplication in the framework of the Correspondence Theory. The putative DC regulate the linear order of the constituents. They have been tested experimentally with nonsense words (Birdsong, 1979), although, as I argued before, many questions about them remain unanswered. DC are presumably applicable to both conditions, reduplicative and conjoined. Indeed, in both conditions speakers may choose to reorder constituents. The default order in reduplication, whereby the base is on the left and the reduplicant on the right, will not always be in agreement with the putative DC. In *pitter-patter,* for instance, the base *patter* is not in its default left edge position.

In contrast, constraints on reduplication, such as RHYME, ALLITERATE, INTEREST regulate not the linear order of the constituents, but the process of creation of a new reduplicative word; <u>they are applicable only to reduplicative binomials</u>. These constraints determine what kind of modification occurs in the reduplicant. It could be a change of onset, resulting in a rhyming structure (e.g., *hanky-panky*), or a change of the stressed nucleus, resulting in an alliterating structure (e.g., *dingle-dangle*). From now on, I will refer to these constraints as to the Correspondence Constraints (CC). My assumption for this study is that Correspondence and Directionality are two independent kinds of constraints.

2.8.1. Directionality in the conjoined condition. Let us illustrate the difference between these two kinds of constraints. In the conjoined condition, when two independent words of the lexicon approach one another, (e.g., *wheel and deal, near and dear)*, speakers are faced with the choice of how to order these two terms, but they are not faced with the choice of creation, because both words already exist. Therefore, CC will not apply. However, if such words happen to exhibit the features of reduplication, such as rhyme, alliteration, or contrastive nuclei, speakers might be more inclined to fuse them together. Although DC apply in the conjoined condition, they would be in competition with more powerful constraints (semantic, metrical, frequency, etc.), and only in the case when more powerful constraints are not active, can we expect that DC will play a role in sequencing of the two items. Mollin (2014) claimed that “only a few non-metrical phonological constraints play a role, and only in the absence of the superior constraints” (p. 107).

2.8.2. Correspondence and Directionality in the reduplicative condition. Let us give an illustration of how both CC and DC interact in a reduplicative formation. Suppose, a speaker of English has an opportunity to create a new reduplicative expression. He or she would be faced with two basic choices: 1. what change (if any) to make in the reduplicant (provided that there is a base as a starting point), and 2. in what order to place the two constituents. For example, if the base is *easy*, speakers may decide to change the onset and create *peasy* or *pleazy* as a reduplicant, or to change the main vowel and to create *osie* as a reduplicant. Some options are less likely: for example, an onset /p/ is less marked than /pl/, therefore, theoretically /p/ would be preferred in the reduplicant. Another consideration is rhyming: *easy-peasy* and *easy-pleazy* do not violate RHYME while *easy-osie* does. These kinds of choices would be regulated by Correspondence constraints, such as RHYME, ALLITERATE, INTEREST, and more specific markedness constraints. On the other hand, after the choice on the modification is made, speakers would be faced with another choice, this time pertaining to the order in which they would produce the base and the reduplicant. In this particular case the reordering is unlikely, because *easy-peasy* complies with ICN, but theoretically, the reordering is possible, as it could be observed in the case of *pitter-patter*, where *patter* is the base.

2.8.3. Markedness and contrast. Previous studies in reduplication have suggested a few different answers to the question of why some segments in the reduplicant emerge as different from the corresponding segments in the base. In this section I'll describe two possible answers to this question – <u>markedness</u> and <u>contrast</u>.

According to Yip (2000), <u>markedness</u> plays a critical role in reduplication: if, for example, markedness constraints are highly ranked, and the base happens to contain a marked onset, then the process of reduplication will try to "improve" the base by changing the marked onset segment in the base to an unmarked one in the reduplicant.

This would result in a rhyming pattern, as in example /builui/ from Yip (see Tableau 1). A similar process presumably would occur when the base contains a marked nucleus; in this case the reduplicant will end up having a less marked nucleus. This would result in an alliterating pattern. Thus, segmental changes that occur in the process of reduplication are usually triggered by markedness constraints. However, constraints like *REPEAT (Yip, 1998) and INTEREST (Minkova, 2002) are not as much linked to markedness as they are to the concept of contrast between the base and the reduplicant.

The idea of reduplication as being motivated by an esthetic need to hear two contrastive sounds, inserted into the same frame, is a very interesting one. The frequent pairing of /I/ and /æ/ in words like *riff-raff* may have become the prevalent pattern in ablaut formations not because one of these vowels is less marked than the other, but because their combination results in a salient perceptual distinction between the base and the reduplicant. Minkova (2002) has developed this idea, arguing that unlike copy reduplication, ablaut and rhyme reduplicative words are "more aggressively creative". She continues: "Variation is a great desideratum in verse (…) It is possible to imagine that a template which started as a recurrence of completely identical structures was changed in a particular way in response to the general principle of Interest changing either the vowel or the consonant in the iteration of the first foot. Shall I shall I is a perfect reduplication, but shilly-shally is more esthetically gratifying" (p. 149). Echoing her words, Arleo (2009) argues that "ablaut reduplication, which involves a highlighted changing figure against a repeated ground, also appears to have fairly close analogues among other expressive semiotic systems, notably the visual arts and music. One easily visualized illustration would be evolving contrasted curved and rounded “vocalic figures” (danced, drawn or filmed) set against repeated angular “consonantal” shapes” (p. 320).

2.8.4. Most common patterns of reduplication: Rhyming and ablaut. In this study I adopt this idea of a possible constraint INTEREST as a motivation for using contrasting segments in reduplication. INTEREST militates against monotony; it forces a change in the reduplicant, such that the base and the reduplicant contain two corresponding segments that are maximally contrastive. Which particular segments are going to be contrastive in the final product of reduplication may depend on the ranking of RHYME and ALLITERATE. If RHYME >> ALLITERATE, then reduplicative formations will have contrastive onsets. If ALLITERATE >> RHYME, then reduplicative words will have contrastive nuclei. In English and French, aside from copy reduplication (which will not be investigated in this study), two main kinds of reduplication exist: ablaut and rhyme, as exemplified below:

(13). a. English, rhyme: *mambo-jumbo, razzle-dazzle*

b. English, ablaut: *riff-raff, flim-flam*

c. French, rhyme: *pêle-mêle, pique-nique*

d. French, ablaut: *prêchi-prêcha, patati-patata*

From the examples listed above, one can see that rhyming reduplicative words comply with the constraint RHYME, and that ablaut words comply with ALLITERATE. Impressionistically, rhyming words seem to be more common in English than ablaut words, since ablaut is no longer a productive phenomenon. As Minkova (2002) pointed out, most ablaut reduplicative words were formed during the sixteenth and seventeenth centuries (p. 139). Only a handful of ablaut words came into the English vocabulary during the twentieth century, among which are *hip-hop, ping-pong, ticky-tacky.* Also, rhyming words may be preferred, because of their connection to poetry.

It would be interesting to test which structure in reduplication (rhyme or ablaut alliteration) speakers tend to prefer. To my knowledge, this has not been done to date. If speakers tend to prefer rhyming patterns, this would provide evidence for the hypothesis that RHYME may be a stronger constraint than ALLITERATE. I hypothesize that this may be the case for English. This study is not an OT account, and no strong claims regarding the constraint hierarchy will be made. However, experimental work has its merits in testing the relative strength of constraints, posited in theoretical literature. This study will provide evidence that rhyming patterns may be on average preferred in English, and will investigate if the same pattern holds in French.

Rhyme may be a feature in reduplication that speakers prefer to hear, but English rhyming reduplicatives sometimes have a complex onset in one of the constituents, as illustrated below:

(14). *harum-scarum, helter-skelter, nitty-gritty, bitchen-twitchen, crawly-mawly, hackum-plackum, highty-flighty*

Although binomials in examples above comply with RHYME, they contain a marked structure, a complex onset. In OT accounts, complex onsets may be banned with the constraint *COMPLEX ONSET[5]; but if a reduplicative with a complex onset

[5] In some OT accounts of reduplication structures with complex onsets would be considered violations of faithfulness constraints, such as DEP-BR. For example, Minkova (2002) gives an example *rif-brif* in one of her tableaux. The candidate *rif-brif* violates DEP-BR, a constraint against epenthesis.

surfaces, it may lessen the attractiveness of the rhyming pattern. I hypothesize that speakers on average would judge reduplicatives in (14) less acoustically pleasing than rhyming reduplicatives with simple onsets (see (13) a.), and perhaps even non-rhyming ablaut reduplicatives (see (13) b.). This tendency may be even stronger in French, because, as a syllable-timed language, French tends to be less tolerant of consonant clusters in various linguistic structures.

So far, I have identified three patterns in reduplication that will be tested in terms of the strength of their acoustic attractiveness. They include rhyming patterns with simple onsets (e.g., *hanky-panky*), rhyming patterns with complex onsets (e.g., *harum-scarum*), and reduplicative alliterating patterns (e.g., *pitter-patter*). My hypothesis is that on average speakers would prefer rhyming patterns with simple onsets. Structures like *hanky-panky* would be the preferred choice, since they comply with RHYME, the constraint that I anticipate to be strong cross-linguistically. Structures like *helter-skelter* may be the second preference, since they don't violate RHYME. Finally, structures like in *trick-or-treat* and *flim-flam* would be the last choice, since they only comply with ALLITERATE, which I anticipate to be a weaker constraint. For French, my expectations are slightly different: structures like *tohu-bohu* may be the preferred structure in French, since they only violate ALLITERATE. Structures like *méli-mélo* would be the second choice, and structures like *rogne et grogne* would be the most infelicitous choice for French speakers, since complex onsets may be more marked in French than in English.

2.8.5. Moraicity and labiality in ablaut reduplication. In addition, the relative strength of the two high-ranked constraints for ablaut reduplication would be interesting to explore as well. Minkova (2002) claimed that the first element of ablaut words represents a nearly perfect case of fixed segmentism: in the vast majority of English ablaut words the first nucleus is /I/. The choice of the second nucleus is more open, but it is limited by several constraints, one of which is mostly quantitative (Ident-BR (μ)) and the other mostly qualitative (*Pl/Lab). The question that seems pertinent is: which constraint would the speakers rather violate – a constraint on the quality of a nucleus or a constraint on the quantity of a nucleus? According to Minkova's (2002) constraint hierarchy, the most infelicitous structure in ablaut reduplication would be the one where the moraic composition of the two nuclei is not identical. Indeed, in existing English ablaut reduplicative patterns like /rIf-rif/ are unattested. However, this pattern exists in conjoined binomials, such as *trick or treat.* It would be interesting to see what option speakers would select when forced to choose between two violations: a violation of Ident-BR (μ) in /rIf-rif/ or a violation of *Pl/Lab in /rIf-rʊf/. My hypothesis is that Minkova's ranking is correct, and that the violation of Ident-BR (μ) would be more serious than the violation of *Pl/Lab. This ranking is given in (15):

(15). Ident-BR (μ) >> *Pl/Lab

2.8.6. Summary. Summarizing, I have discussed both Directionality and Correspondence constraints in this section. DC that will be investigated here are listed in (3). With respect to Correspondence, my goal is to provide preliminary evidence on how the constraints listed in (16) are ranked in English and French.

(16). **RHYME:** The output must contain at least one pair of adjacent syllables (feet, stressed syllables) with identical rhymes.

ALLITERATE: The output must contain at least one pair of adjacent syllables (feet, stressed syllables) with identical onsets.

Ident-BR (μ): Correspondent segments have identical moraic content. This constraint militates against moraic discrepancies in corresponding segments in the base and the reduplicant.

***Pl/Lab:** Labial vowels are prohibited.

Chapter 3: Methods

3. Rationale, Research Questions, and Methodology

3.1. The rationale for this study. The rationale for this research is grounded in the need to conduct more cross-linguistic studies on phonological patterns of binomial locutions, as well as in the need to understand how those phonological patterns are processed and learned by both native and non-native speakers.

In every language, there are sound patterns that are used in expressive contexts; I argue that binomials represent one of such contexts. A very broad question that has led to this research agenda was: "What does linguistic expressivity mean, in both general and language-specific terms?" My assumption is that the phonological patterns that I have discussed in the previous chapter are the patterns that speakers associate with expressive use of language. Although testing of the psychological reality of the putative constraints has been done before, we still know little about how (dis)similar they are and how strong they are in various languages. Even less is known about the non-native processing of the phonology of binomial locutions; for instance, to what extent are the putative rules learnable by non-native speakers?

This research study contributes to the effort of filling these gaps in knowledge. First, the psychological reality and the relative strength of several constraints are tested for French and English. Second, this study investigates if advanced learners exhibit native-like intuitions on the task of judging the phonological felicity of binomial structures.

3.2. Research objectives and hypotheses. The following research goals and hypotheses were formulated for this study:

1. to test the psychological reality of all the Directionality constraints listed in (17), using nonsensical expressions.

(17). **Initial consonant number (ICN):** the 1st element has fewer initial consonants compared to the 2nd (e.g., *harum-scarum*).

Initial Sonority (IS): the 1st element has a more sonorous initial consonant compared to the 2nd (e.g., *wear and tear*).

Vowel Quality (VQ): the 1st element has a fronter and higher stressed vowel compared to the 2nd (e.g., *pitter-patter*).

Vowel Length (VL) for English: the 1st element has a shorter stressed vowel compared to the 2nd (e.g., *trick or treat*).

Vowel Nasality (VN) for French: the 1st element has a stressed oral vowel, while the 2nd element has a stressed nasal vowel (e.g., *pieds et poings liés*)

Final Consonant Number (FCN): the 1st element has fewer final consonants compared to the 2nd (e.g., *leaps and bounds*)

Final Sonority (FS): the 1st element has a less sonorous final consonant compared to the 2nd (e.g., *rock-and-roll*).

My hypothesis is that English native speakers would be sensitive to these constraints in various degrees, while French speakers may only be moderately sensitive to VQ, as previous research has shown (Birdsong, 1979). VQ was predicted to be the strongest constraint in English as well.

2. to compare the performance of advanced L2 learners to the performance of native speakers for both languages. I anticipate that advanced L2 learners would perform similarly to the native speakers, although there would be more variation in their responses, since factors such as the age of L2 exposure, the regularity of L2 use, and the motivation to sound like a native speaker may affect L2 learners' performance on this task. These three factors will be measured with the Bilingual Language Profile (BLP). A particularly interesting discussion could be centered around the question whether native speakers of English would apply their English intuitions to French, a language with less systematic phonological patterns in binomial locutions. Non-native speakers may differ in the inclination to transfer their native intuitions into non-native contexts, however, since I decided to include only advanced non-native speakers, this inclination may be weak, or may depend on the aforementioned factors.
3. to provide preliminary evidence on the relative strength of the Correspondence constraints, listed in (18).

(18). **RHYME:** The output must contain at least one pair of adjacent syllables (feet, stressed syllables) with identical rhymes.

ALLITERATE: The output must contain at least one pair of adjacent syllables (feet, stressed syllables) with identical onsets.

Ident-BR (μ): Correspondent segments have identical moraic content. This constraint militates against moraic discrepancies in corresponding segments in the base and the reduplicant.

***Pl/Lab:** Labial vowels are prohibited.

This will also be done with nonsensical expressions; for example, I propose to juxtapose nonsensical expressions that rhyme with nonsensical expressions that alliterate. I anticipate that both French and English speakers would on average prefer rhyming patterns, although this preference may be weaker when a rhyming pattern contains a marked structure, such as a complex onset. I also anticipate that Ident-BR (μ) is a higher-ranked constraint in relation to *Pl/Lab.

4. Finally, an additional objective was to determine if there are any differences in speakers' intuitions in two conditions – conjoined and reduplicative.

3.3. Design of materials. The rules that were tested are summarized in Table 1. As discussed previously, they fall under two main categories: 1. Directionality constraints; 2. Correspondence constraints. DC has six subcategories, and CC has four subcategories (four juxtapositions). Along with the examples of natural binomials from English that obey a putative rule, I have listed examples of nonsensical items that are used in this study. The complete sets of experimental items are given in Appendices A and B, for English and French respectively.

Table 1. Phonological Rules Tested in this Study.

Category	**Sub-category**	**Hypothesis**	**Examples of naturally occurring binomials**	**Examples of nonsense words used in the experiment**
<u>Directionality</u>	Initial Sonority (IS)	the 1^{st} element has a more sonorous initial segment compared to the 2^{nd}	*hanky-panky*	*loogle-boogle; lanties and vanties*

Table1, cont.

	Final Sonority (FS)	the 1st element has a less sonorous final segment compared to the 2nd	*rock-and-roll*	*bickesh-bickell; resteg and restell*
	Final Consonant Number (FCN)	the 1st element has fewer final segments compared to the 2nd	*leaps and bounds*	*revec-revect; boteec and boteect*
	Initial Consonant Number (ICN)	the 1st element has fewer initial segments compared to the 2nd	*helter-skelter*	*kizzy-krizzy; pengster and plengster*
	Vowel Quality (VQ)	the 1st element has a fronter and higher stressed vowel compared to the 2nd	*wishy-washy, tit for tat*	*lisket-lasket; steckel and stockel*
	Vowel Length for English ONLY (VL) Vowel Nasality for French ONLY (VN)	the 1st element has a shorter stressed vowel compared to the 2nd the 1st element has a stressed oral vowel, while the 2nd element has a stressed nasal vowel	*trick or treat* *bel et bien*	*clisty-cleesty; spullky and spoolky* *gonais-gonin; ni flita ni flitan*
<u>Correspondence</u>	Rhyming pattern vs Ablaut pattern	Rhyming patterns would be preferred over ablaut patterns	Ablaut: *pitter-patter* Rhyme: *loosey-goosey*	Ablaut: *fiply-faply* Rhyme: *fiply-biply*
	Ablaut vs Rhyming pattern with a complex onset	For English, rhyming patterns would still be preferred to ablaut patterns; for French, ablaut may win on this particular juxtaposition	Ablaut: *dilly-dally* Rhyme with a complex onset: *helter-skelter*	Ablaut: *kiply-kaply* Rhyme with a complex onset: *kiply-kriply*

Table1, cont.

	Rhyming pattern with a simple onset vs Rhyming pattern with a complex onset	Rhyming patterns with simple onset will be preferred	Rhyme with a complex onset: *helter-skelter* Rhyme with a simple onset: *loosey-goosey*	Rhyme with a complex onset: *siply-sliply* Rhyme with a simple onset: *siply-tiply*
	Ident-BR(Mora) vs *Pl/Lab	Ident-BR(μ)>> *Pl/Lab A violation of Ident-BR(μ) should be worse than a violation of *Pl/Lab	A binomial that violates Ident-BR(μ): *trick or treat* A binomial that violates *Pl/Lab: *whistle and flute*	A nonsense item that violates Ident-BR(μ): *filky-fealky* A nonsense item that violates *Pl/Lab: *filky-fulky*

Several features of the design of the experimental items should be noted. First of all, for each DC and for each juxtaposition of CC ten pairs of items were created. In total, 60 pairs of nonsense expressions were created to test DC and 40 pairs of nonsense expressions were created to test CC, which brought the total number of experimental pairs to one hundred. To avoid additional confounds related to the number of syllables, all the nonsense items were made disyllabic. One half of the items were used in the reduplicative form, and the other half in the conjoined form, with the conjunction *and* for English and *ni ... ni* for French. The choice of the *ni …ni* conjunction for French as opposed to *et* or *ou* was motivated by the possibility of resyllabification, which is an underlying process that native speakers of French are hypothesized to use when segmenting a speech signal. The following example illustrates how a coda of the first element may be resyllabified to become the onset of the following syllable, if this syllable starts with a vowel:

(19). *Bel et bien*

bɛ -le – bjɛ̃

Since for some of the constraints, such as Final Sonority, codas of the first constituent of a binomial needs to be preserved, it was imperative to use a conjunction that does not start with a vowel. I ended up choosing a *ni... ni* for French items, since it is a rather common conjunction that occurs in real French binomials.

The experimental items do not strongly resemble any real words in English or French. To make sure that this is indeed the case, the items were first discussed with native speakers of the respective languages. In case when these speakers considered some items to be strongly associated with the existing words, these items were replaced. Furthermore, the following precautions were taken while designing the items:

1. Initial Sonority. Since the segment of interest is located in the first syllable, all the items for this constraint were stressed on the first syllable (for English only, because for French it would be ungrammatical to have a stress on the first syllable). For both languages, I based the item design on the following sonority scale, also used in the study of Benor and Levy (2006):

(20). vowels, ʔ > h > j > w > r > l > nasals > fricatives > stops

2. Final sonority. For this constraint the segment of interest is located in the second syllable, therefore, all the items for this constraint were stressed on the second syllable (this works for both languages). I used the same sonority scale as in (20).

3. Final Consonant Number. The segment of interest for this constraint is located in the second syllable. Thus, all the items were stressed on the second syllable, for both English and French. I used only stops and fricatives as final consonants. Crucially, all the final consonant clusters were either **both** stops, or **both** fricatives. This was done to avoid any confounds related to final sonority. Consider the example of *seroap-seroapt.* In this nonsense expression, the first item ends in *p*, which is a stop, and the second item ends in *pt*, both of which are stops. By designing items in this way, I intended to keep constant the consonant after the stressed vowel, so that there is no modification in the length of the vowel. Secondly, by using only stops as final consonants, I kept the final sonority of the two constituents the same, so that *seroap* is different from *seroapt* **only** in the number of final consonants. In other words, if I used items like *seroap-seroaps*, where *seroap* is different from *seroaps* in the final consonant number **and** the final sonority, it would be reasonable to say that there is a confound and that the two constituents are not minimal pairs.

4. Initial Consonant Number. All the items for this constraint were stressed on the first syllable for English, and on the second syllable for French. The initial sonority of the two constituents was kept the same. For example, in *beetow and breetow* the two constituents are minimal pairs, since they only differ in the number of initial consonants, their initial sonority being the same.

5. Vowel Quality. Two kinds of alternations were used within this block. Previous discussion showed that both vocalic height and vocalic advancement can be used as a measure of vowel quality change, and that some binomials differ mainly in height of their stressed vowels (English: *tit for tat*, French: *comme ci comme ça*), and others differ mainly in advancement of the stressed vowels (English: *hem and haw*; French: *bique et bouc*). Therefore, half of the items in this block differed mainly in vocalic height (*rigster and ragster*), and the other half mainly in vocalic advancement (*lesky and losky*). The items were stressed on the syllable that contained the target vowel. For the height dimension, we used the alternation of /I/ and / æ/, based on the following height hierarchy (Benor & Levy, 2006):

(21).	High		Mid		Low
	i, u, I, ʊ	>	e, o, ɛ, ɔ, ʌ, r	>	æ, ɑ

For the advancement dimension, we used the alternation of /ɛ/ and /ɑ/, based on the following advancement hierarchy (Benor & Levy, 2006):

(22).	Back		Front
	u, o, ɔ, ʌ, ʊ, r, ɑ	>	æ, ɛ, e, I, i

As I mentioned already before in the previous discussion, my goal was to use minimal pairs that differ only in the quality of the main vowel. However, it is not possible to do so, because there are no vowels differing exclusively in quality. Although /I/ and /æ/ were judged a good pair for testing sensitivities to vowel height, these two vowels also differ in phonetic duration, /I/ being intrinsically shorter than /æ/. Similarly, for the testing of the sensitivities to vowel length (see below), I tried to create pairs that differed

mostly in the phonological duration of the stressed vowel, although qualitative differences between the chosen vowels are present and to a large extent unavoidable.

6. Vowel Length (for English only).[6] We used two kinds of alternations in this block: /I/ vs /i/ and /ʊ/ vs /u/. This was based on the following two-way phonological length distinction, used in Benor and Levy's (2006) study:

(23). **short vowels:** æ, ɛ, I, ʌ, ʊ

long vowels, including diphthongs: ɑ, e, i, o, u, ɔ, æʊ, aI, aʊ, r, Vr

All the items of this block were stressed on the syllable which contained the target vowel.

7. Vowel Nasality (for French only). The items that exemplified the putative constraint on vowel nasality were of two kinds: those that had an open stressed syllable (*flita-flitan*) and those that had a closed stressed syllable (*goudette-goudinte*). The segment of interest was therefore half of the time in an open syllable and the other half of the time in a closed syllable. Since this constraint has never been tested before in this particular paradigm, my exploratory goals were to test these two conditions in order to see if subjects are more sensitive to the items like *goudette-goudinte*, where the nasal vowel undergoes additional lengthening (Féry, 2003) than to the items like *flita-flitan*, where there is no additional lengthening. I used the alternations of /ɔ/ and /ɔ̃ /, /ɛ/ and /ɛ̃/, and /ɑ/ and /ɑ̃/.

8. Rhyming pattern vs. ablaut pattern. The objective for this juxtaposition is to investigate what sounds more acoustically pleasing to the respondents – rhyming patterns

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[6] It is hard to test Vowel Length for French using minimal pairs, since in French vowels lengthen when they are followed by certain consonants, such as /r/. Birdsong (1979) used non-minimal pairs to test VL for French (e.g., *spique et spire*), which is not ideal, because in such pairs not only the length of the vowel differentiates the constituents, but also the sonority of the last consonant.

or ablaut patterns. This test would allow to collect preliminary evidence on the relative strength of RHYME and ALLITERATE in English and French. For this second block experimental pairs were designed in such a way that the first out of two constituents was always the same, for example, *fiply-faply* vs *fiply-biply*. In both of these pairs the first element is *fiply*, but the last element is either *faply* or *biply*. *Fiply-faply* violates RHYME, but does not violate ALLITERATE. *Fiply-biply* violates ALLITERATE, but does not violate RHYME. All the nonsensical items had the stress on the first syllable for English, and on the second syllable for French, because those are the most natural metrical patterns for the respective languages for the disyllabic binomials.

Also, I made an effort to avoid the confound of the Directionality constraints for this block, although not all the Directionality constraints were sufficiently researched in the past, especially for French. For English I used the formulation of DC from Cooper and Ross' (1975) study, even though not all of these constraints have been experimentally tested. Thus, *fiply-biply* is sequenced in accordance with IS, and *fiply-faply* is sequenced in accordance with VQ. Due to the lack of similar research for French, and due to the impressionistic insufficiency of phonological patterns in real French binomials, I decided to order all the French items of this block in accordance with the DC for English. Thus, a French item like *sagli-tagli* is sequenced in accordance with IS for English, since little is known about how IS is working in French.

9. Ablaut pattern vs. rhyming with a complex onset. For this juxtaposition, the main principles remained the same: the first constituent was the same in both pairs, and the items were ordered in accordance with the DC for English. For example, *sipoth and* *sapoth* instantiate ablaut, while *sipoth and slipoth* instantiate a rhyming pattern with a complex onset, such as in *helter-skelter*. *Sipoth and slipoth* is sequenced in agreement with ICN, formulated for English. Stress patterns were the same as for the previous juxtaposition: stress was on the first syllable for the English items, but on the second syllable for the French items.

10. Rhyming pattern vs. rhyming with a complex onset. Experimental items that instantiate this juxtaposition are, for example, *siply-tiply* (instantiates rhyming) and *siply-sliply* (instantiates rhyming with a complex onset). Stress patterns were the same as for previous juxtapositions.

11. Ident-BR(μ) vs. *Pl/Lab. Items that exemplify these two constraints for English are *filky-fealky* (violates Ident-BR(μ), but does not violate *Pl/Lab) and *filky-fulky* (violates Pl*/Lab, but does not violate Ident-BR(μ)). Items that exemplify this juxtaposition for French are *glavette-glavinte* (violates Ident-BR(μ), but does not violate *Pl/Lab) and *glavette-glavotte* (violates *Pl/Lab, but does not violate Ident-BR(μ)). It is assumed that nasal vowels in French are bimoraic (Féry, 2003), while lax are monomoraic (such as /ε/ in *glavette* and /ɔ/ in *glavotte*). Stress patterns were the same as for the previous juxtapositions.

After all the items were created and judged appropriate for the study, a male native speaker of English (from New York state) and a male native speaker of French (from Lyon) were asked to help with the recordings. All the nonsense expressions were inserted into the same carrier sentence and occupied a phrase-final position. For example, the English carrier sentence was “He told me about ...”, with a nonsense expression as a final segment. After the recording, each nonsensical expression was spliced out of the carrier sentence and combined into one recording with its counterpart. One interstimulus interval of 5 ms was inserted between two pairs, and another interstimulus interval of 7 ms was inserted between the two repetitions of the same pair, as illustrated in Figure 2:

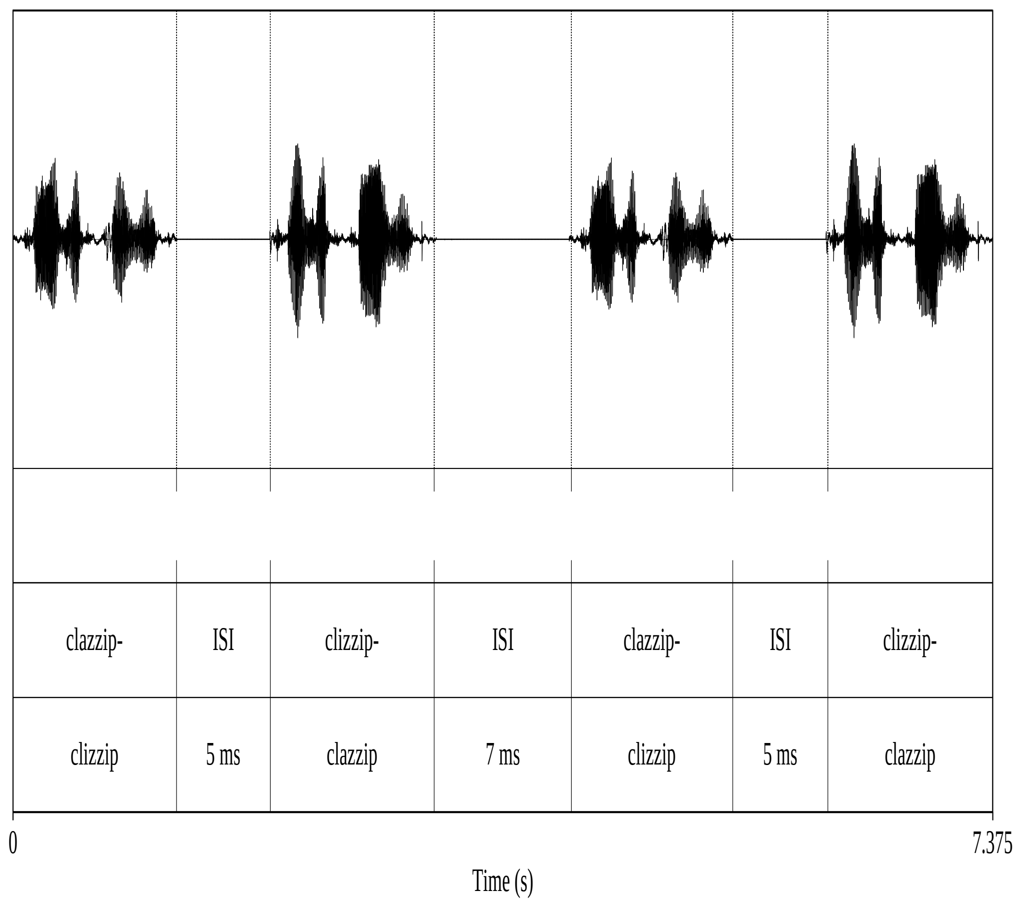

Figure 2. A Test Stimulus with ISIs of 5 ms and 7 ms.

After that I proceeded with creating a full electronic version of the study. Praat (5.3.55) and Audacity (2.0.5) were used for the creation of the sound files appropriate for the study, and PsychoPy Software Package (v1.82.01) was used for the creation of the electronic version of the experiment.

3.4. Participants. The participants of the study fall into four categories:

1. 17 native speakers of American English (14 females, 3 males, mean age = 22.2 years).
2. 18 non-native speakers of English (11 females, 7 males, mean age = 23.2 years). Among them there were native speakers of Mandarin, Cantonese, Korean, Bengali, Gujarati, Malayalam, Spanish, German, Italian, and Czech. 6 non-native speakers in the sample appear to be early bilinguals (Language History score on the BLP is 50 or above). Others seem to be late bilinguals, but they all identified themselves as proficient in English, with either multiple years of studying English in the classroom, or multiple years of residence in the U.S., or both.
3. 16 native speakers of French (12 females, 4 males, mean age = 26 years). Among these speakers one was from Belgium, and the rest of them were from different regions of France. Due to the difficulties of finding enough participants for this group, I have initially accepted speakers from different geographical regions (including Quebec and francophone Africa), provided that French was their first language of exposure. However, as the sample grew larger, I decided to perform the final analysis only on the speakers of the European French, to avoid any confounds related to the geographical region.

4. 16 non-native speakers of French (11 females, 5 males, mean age = 25.9 years), who were all native speakers of American English. All the speakers of this group identified themselves as non-native but proficient speakers of French. Several participants of this group had spent a year or more in a francophone country, others studied French for a long period of time in the classroom, and some had both classroom and native environment experiences.

Initially, there were more participants in each of the four groups, but I had to exclude certain subjects, for one of the following reasons: 1. if their age did not fit the description (all the subjects had to be between 18 and 40 years) 2. if they grew up bilingual from birth 3. if their BLP scores were not interpretable. Most of the participants were recruited among the students of two American universities – the University of Utah and the University of Texas at Austin. A recruitment sign was used as advertisement posted on campuses, distributed in upper division and graduate classes, posted on various websites, disseminated through social media, emails to colleagues, and by word of mouth.

3.5. Procedure. Both experiments (English and French) were conducted in two places, on campus of the University of Utah in Salt Lake City and on campus of the University of Texas at Austin. A quite room was used for the study. Each participant first read the Consent Form (Appendix C) and gave their verbal agreement to take part in the study. Then, after a short phase of instructions with one example, the main experiment took place. The experimenter was only present in the room during the instruction phase, to make sure that the subjects understood the task. When the participants confirmed that they understood the task, the experimenter left the room. For the vast majority of participants the main task took about 40 minutes to complete. Non-native speakers also completed the Bilingual Language Profile (BLP) on paper, which may have taken additional 5 to 10 minutes.

The nonsense locutions of the first block (Directionality block) were presented on a computer screen both visually and auditorily. Each screen contained an expression in the predicted order and in the opposite order, based on the putative Directionality constraints. Below the expressions a scale from 1 to 6 was displayed (see Figure 3). The participants listened to the expressions displayed on the screen, and then clicked on one category of the scale that corresponded to their preference. For example, if they preferred the expression on the right side of the screen they clicked on either 6 (strong preference), 5 (moderate preference), or 4 (mild preference). On the other hand, if they preferred the expression on the left side of the screen, they clicked on either 1 (strong preference), 2 (moderate preference), or 3 (mild preference). In this particular case (see Figure 3), the participants first saw this screen and heard *lisket-lasket* (predicted order), and then, after a short pause of 5 ms, they heard *lasket-lisket* (the opposite order). This was repeated twice. The ISI between the two repetitions was set at 7 ms. for all the pairs (see Figure 2). Then the participants made their choice by clicking on one of the six numbers on the scale. The predicted order appeared half of the times on the right, and half of the times on the left side of the screen.

The second block (Correspondence block) followed the first one immediately. There was no pause between the two blocks, thus, other than the difference in the structure of the items, there was no direct indication that the second block was a separate part of the test. It consisted of 40 items. The manner of presentation of the items of the second block was identical to the one used for the Directionality block. Figure 4 gives an image of a screen with the items from the second block. In this particular case, both expressions, *fiply-biply* and *fiply-faply*, are sequenced in the predicted order; however, the first word violates the constraint ALLITERATE, but does not violate RHYME, while the second word violates RHYME, but does not violate ALLITERATE. Thus, each of these two expressions violates one of the constraints.

Figure 3. A Screenshot from the Directionality Block.

According to our hypothesis, if subjects on average prefer *fiply-biply*, that would mean that RHYME is a higher-ranked constraint than ALLITERATE, which is the result that I anticipated to find.

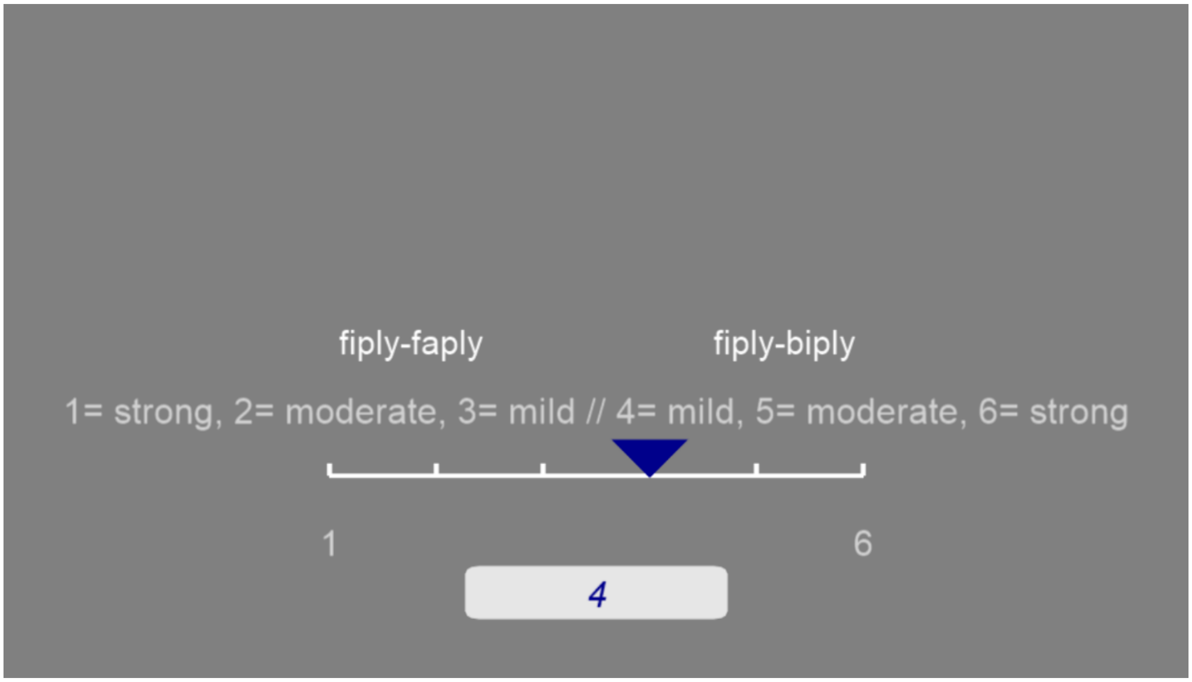

Figure 4. A Screenshot from the Correspondence Block.

3.6. Data analysis. The collected data from all the subjects were first prepared for the analysis. Recall that half of the items in the predicted order were presented on the left of the screen (with the scores 1, 2, and 3 associated with the predicted order), and the other half of the items in the predicted order appeared on the right of the screen (with the scores 4, 5, and 6 associated with the predicted order). For my analysis of Directionality Constraints, I needed the scores associated with the predicted order to always be 4, 5, or 6, and the scores associated with the unpredicted order to always be 1, 2, or 3. In this way, if subjects exhibit sensitivities to a particular constraint in the predicted direction, their scores would be between 3.5 and 6. The level of indifference was defined as 3.5, which is a middle point in this scale. I used a function written in R to adjust the initial scoring system and to make it suitable for my needs. The "clean" set of scores was written into a separate Excel File, and then the mean for each participant for each constraint was calculated. These means were used for the analysis of Directionality Constraints, performed with the use of R and SPSS statistical software packages.

Similarly, for the analysis of the CC, I first used an R-function to transform the raw scores into a system of scores that was suitable for my needs. Specifically, I transformed all the scores into 1, 2, or 3. If, for example, a particular participant had to choose between *fiply-faply* and *fiply-biply*, and he ended up choosing the latter expression, this would mean that this participant chose the rhyming pattern *fiply-biply* over the alliterating pattern *fiply-faply*. In this case, the Alliterating pattern would not receive any score, but the Rhyming pattern would receive the score of 1, 2, or 3, depending on the strength of the preference. Thus, if a participant chose *fiply-biply*, and this item appeared on the right of the screen (see Figure 4), then a score of 4 would be transformed into 1, 5 into 2, and 6 into 3. In the opposite case, if a participant chose *fiply-faply*, then the Rhyming pattern would not receive any score, and the Alliterating pattern a score of 1, 2, or 3 (1 would be transformed into 3, 2 will remain 2, and 3 would be changed into 1). As a result of this procedure, columns with scores 1, 2 and 3 for each of the Correspondence constraints were written into a separate file. Then I summed these scores for each participant and used the sums as the input for the paired sample t-tests.

3.7. Summary. The design and the hypotheses of Birdsong's study (1979) served as a basis for the development of the methodology of the present study, although there are a number of important differences between two studies, which I summarize in (24):

(24). **Different experimental items for DC:** For the present study 60 nonsensical expressions (10 for each DC) were created and later recorded for both French and English. The expressions are completely different (with one or two exceptions) from those used in Birdsong's study.

Different populations: Non-native participants in Birdsong's study were either beginners or intermediate learners of English or French. In the present study all the learners are at advanced stages of proficiency. Moreover, in the present study three factors (L2 History, L2 Use, and Motivation) are measured in non-native participants in order to determine if any of these factors are correlated with the performance on the proposed task.

Different constraints included: For DCs, along with IS, FCN, VQ, and VL that were tested in Birdsong's study, the present study also tests FS, ICN and VN. The second CC block, is unique for the present study and was not part of Birdsong's study.

Different procedure: In Birdsong's study, only visual input was used. Thus, participants read nonce expressions on paper (they were encouraged to subvocalize) and indicated which of the two expressions they preferred, using a 5-point scale. The present study uses electronic format and both visual and auditory input. The task is a computer-based judgment task where participants listen to two nonsensical expressions and indicate which of the two they prefer, using a 6-point scale.

Different variables tested: Finally, the present study also includes Condition (reduplicative vs. conjoined) as a variable in an ANOVA, which was not the case for Birdsong's study. The inclusion of this additional variable allows me to test whether participants perform similarly in both conditions.

Chapter 4: Directionality Constraints

4. Results and Discussion

4.1. Results: Experiment 1 (English). This section briefly describes the results of the Experiment 1 for native and non-native speakers of English.

4.1.1. Native English speakers. The descriptive statistical data for 17 native English speakers is displayed in Table 2, and the error bar chart is given in Figure 5.

Table 2. Directionality Constraints for 17 Native English Speakers: Descriptive Statistics.

Statistics	**Initial Sonority (IS)**	**Final Sonority (FS)**	**Final Consonant Number (FCN)**	**Initial Consonant Number (ICN)**	**Vowel Quality (VQ)**	**Vowel Length (VL)**
Means	3.67	3.62	4.32	4.06	4.34	3.67
Standard Deviations	0.43	0.72	0.95	0.67	0.58	0.55

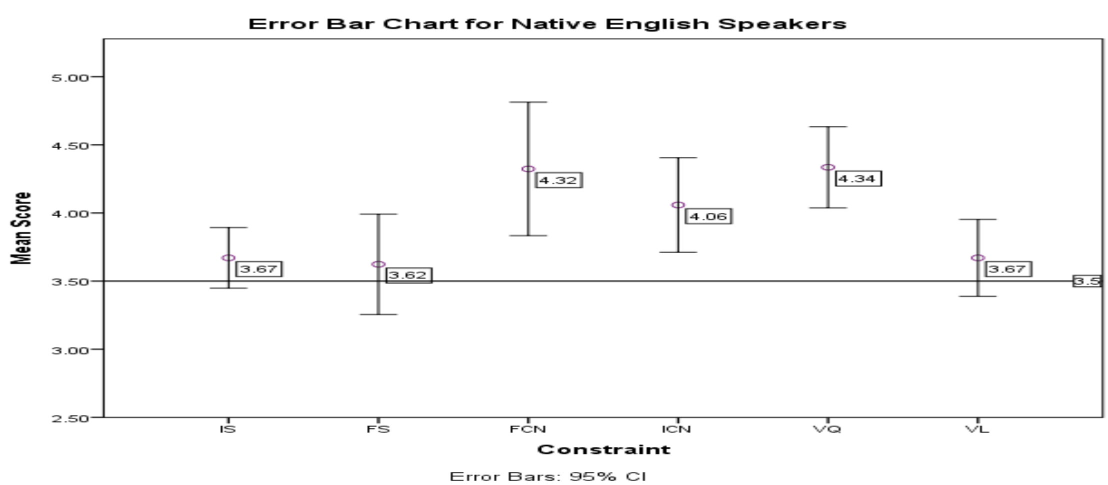

Figure 5. Directionality Constraints for 17 Native English Speakers: Error Bar Chart.

As we can see, all the means for judgments are above the level of indifference, defined as 3.5; however, the means for half of the constraints (IS, FS, and VL) are just barely above 3.5. Specifically, a mixed model with Constraint as a random variable which compared the six means to the level of indifference revealed that the means for three constraints out of six were statistically different from the level of indifference: FCN ($t = 5.06$, $p = .0000$), ICN ($t = 3.44$, $p = .0009$), and VQ ($t = 5.14$, $p = .0000$). Thus, we are able to confirm that native English speakers exhibit sensitivities to the following three Directionality constraints: Final Consonant Number, Initial Consonant Number, and Vowel Quality. These results differ from the results of Birdsong's (1979) study, where judgments for the following constraints were significantly different from the level of neutrality for native English speakers: Vowel Length, Initial Sonority, and Vowel Quality. I'll return to this point in section 4.3.

I also performed an RM ANOVA on this data, with two independent variables: Constraint and Condition. The analysis showed a main effect of Constraint ($F(2.8, 45.2) = 4.43$, $p = .009$, partial eta squared = .22, power = .83), but no main effect of Condition ($p = .51$), and no significant interaction between Constraint and Condition ($p = .06$). Note that the interaction approached significance. This is illustrated in Figure 6. The post hoc Tukey LSD test revealed that results for FCN were statistically different from those for IS ($p = .04$) and VL ($p = .04$), that results for ICN were statistically different from those for IS ($p = .02$) and VL ($p = .03$), and that results for VQ were statistically different from those for IS ($p = .001$), FS ($p = .004$), and VL ($p = .000$). No other statistical differences among the constraints were found.

Overall, the strongest sensitivity was exhibited for VQ and FCN in our sample of native English speakers, followed by ICN. We note that FCN had the largest standard deviation. Condition (conjoined vs reduplicative) does not seem to affect the sensitivity scores for native English speakers.

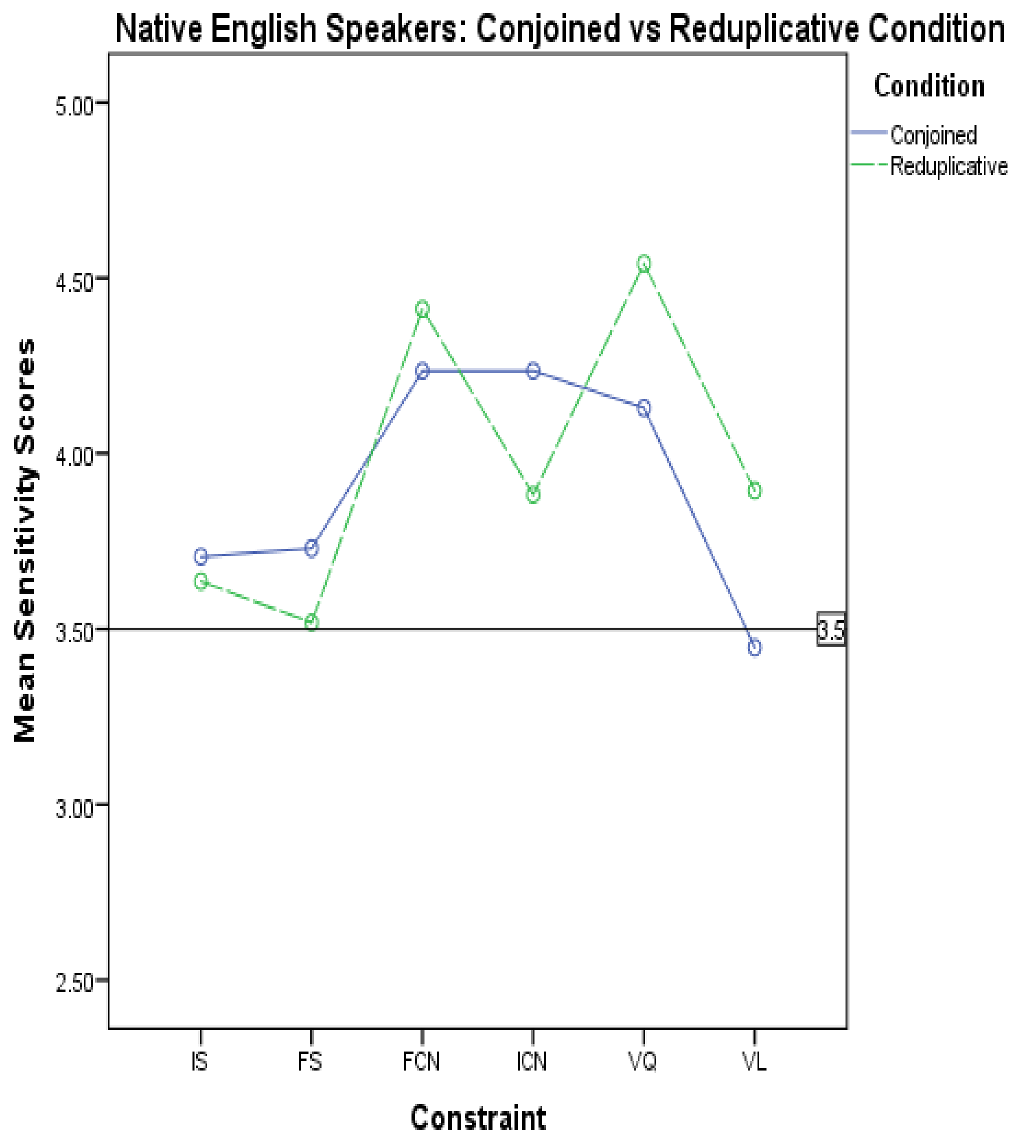

Figure 6. Native English Speakers: Conjoined vs. Reduplicative Conditions.

4.1.2. Non-native English speakers. The mean sensitivity scores for the non-native English group for <u>most</u> constraints ended up being closer to neutrality than those of native speakers. The descriptive statistical data for 18 non-native English speakers is displayed in Table 3, and the error bar chart is given in Figure 7.

Table 3. Directionality Constraints for 18 Non-Native English Speakers: Descriptive Statistics.

Statistics	**Initial Sonority (IS)**	**Final Sonority (FS)**	**Final Consonant Number (FCN)**	**Initial Consonant Number (ICN)**	**Vowel Quality (VQ)**	**Vowel Length (VL)**
Means	3.56	3.27	4.58	3.66	3.88	3.69
Standard Deviations	0.5	0.8	0.7	0.8	0.5	0.6

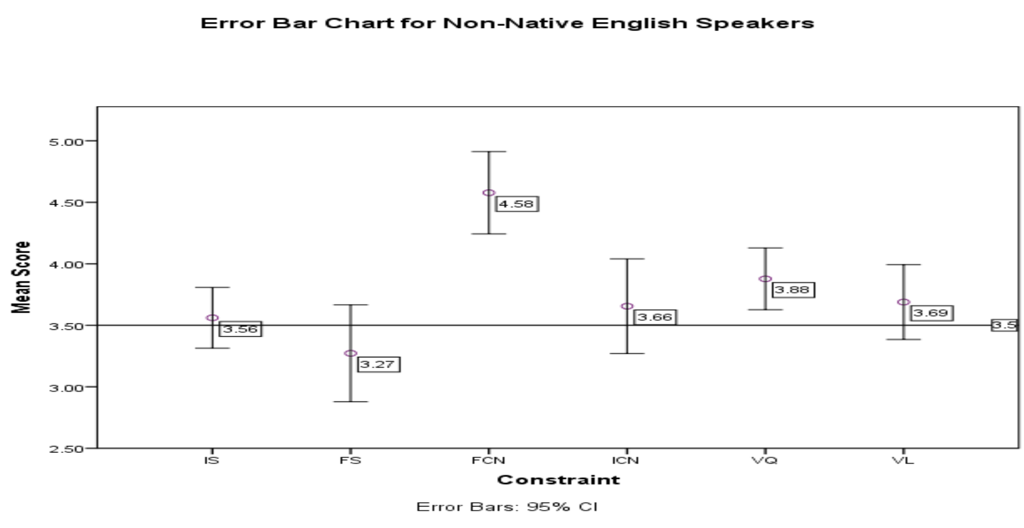

Figure 7. Directionality Constraints for 18 Non-Native English Speakers: Error Bar Chart.

The same analysis as for the natives was performed for the group of the non-natives. A mixed model with Constraint as a random variable which compared the six means to the level of indifference revealed that two constraints out of six were statistically different from 3.5: FCN ($t = 7$, $p = .0000$) and VQ ($t = 2.46$, $p = .02$). ICN, which was significant for native speakers, did not reach statistical significance for the non-natives. Another difference between the two samples is that not all the means are above 3.5 for the non-natives; namely, the mean for FS is below 3.5.

When the six means were compared to each other, using a RM ANOVA with Constraint as an independent variable, Maunchy's test indicated that the assumption of sphericity was violated ($\chi2$ (14) = 33.26, $p = .003$). Therefore, the correction of degrees of freedom with Greenhouse-Geisser estimates of sphericity was used ($\varepsilon = .54$). The analysis showed the main effect of Constraint (F (2.7, 45.8) = 9.63, $p = .000$, partial eta-squared = .36, power = .99). The post hoc Tukey LSD test revealed that results for FCN were statistically different from those for IS ($p = .000$), FS ($p = .001$), ICN ($p = .001$), VQ ($p = .002$), and VL ($p = .000$), and results for VQ was statistically different from those for IS ($p = .03$) and FS ($p = .009$). No other statistical differences were found.

One fact that is very particular to the performance of the non-native English speakers is that they were acutely sensitive to FCN: not only the mean for this constraint was higher than for the natives, but the mean rating for FCN was also significantly different from **all** the other rating means. It is also clear from the visual representation in Figure 7 that FCN error bar does not have any overlap with the error bars for other constraints, which is a further indication of its distinct status.

For the purposes of comparing the performance of the non-natives English speakers to the performance of the native English speakers, a mixed model analysis was performed, with the within-subject factor of Constraint and the between-subject factor of Proficiency Group. There was no observed main effect of Proficiency Group, or interaction between Constraint and Proficiency Group. Figure 8 gives a graphical representation of the performances of the native and the non-native English speakers. Overall, the non-native English speakers performed similarly to the native English speakers.

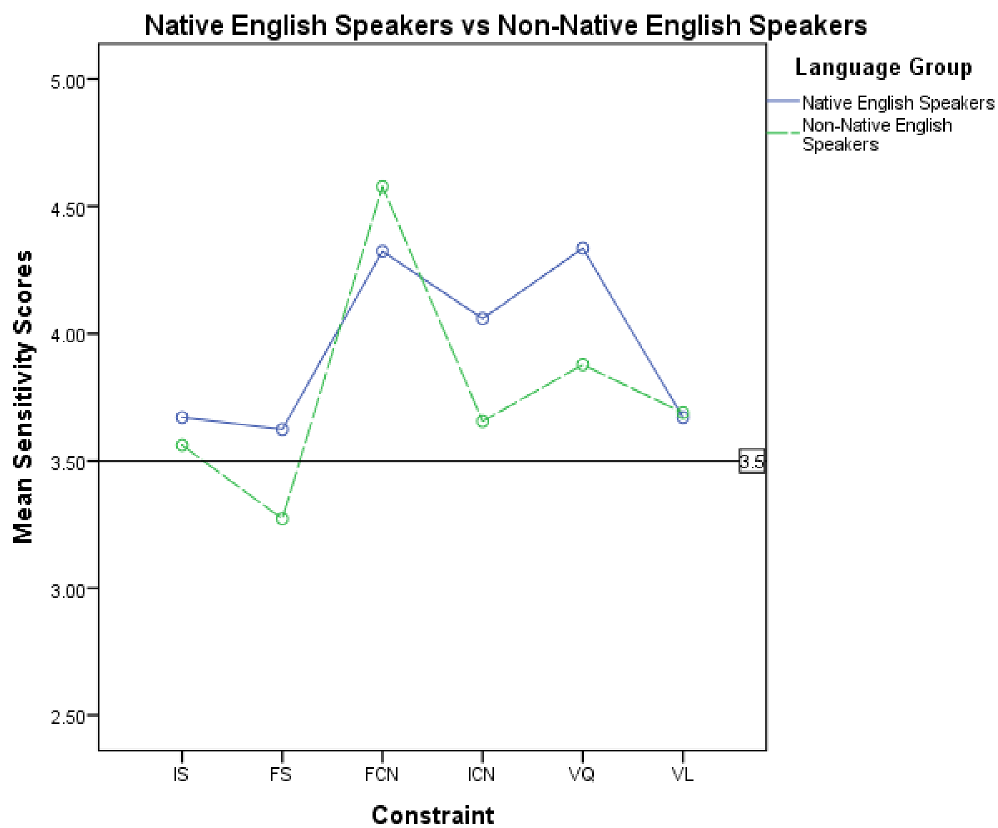

Figure 8. Directionality Constraints: Native vs. Non-Native English Speakers.

4.2. Results: Experiment 2 (French). This section briefly describes the results of the Experiment 2 for native and non-native speakers of French.

4.2.1. French native speakers. French sensitivity scores that were obtained from 16 native speakers of European French show some similarities and some differences with respect to the native English speakers. For example, the same three constraints that had the highest means for English also have the highest means for French (FCN, ICN, and VQ). FCN has the largest standard deviation for both groups. However, all the French means are lower than the English means. Moreover, the means for IS and FS are below the level of indifference for French speakers, which suggests that their preferences for these two constraints may have a reverse directionality compared with the English native speakers (see Figure 9). The descriptive statistics are displayed in Table 4, and the error bar chart is given in Figure 9.

Comparing the mean ratings of French native speakers to the level of indifference yielded the following results: the mean rating for VQ was statistically significant from 3.5 ($t = 2.07$, $p= .04$) and the mean rating for IS was at the threshold ($t= -1.96$, $p= .05$). Thus, with this small sample support for the sensitivity of the French speakers to two out of six DC was found. What is especially interesting is that most French speakers seem to prefer the opposite directionality for IS compared to the native English speakers' intuitions. The same trend that was found in Birdsong's study, although there statistical significance was not reached. This finding will be considered later in section 4.3.

An RM ANOVA with two independent variables, Constraint and Condition, was also performed for this group. A significant main effect of Constraint was not observed, although it approached significance (F (2.4, 36.7) = 2.6, p = .078, partial eta-squared = .15, power = .54). This is another striking difference between the French native speakers and the English native speakers: French natives had roughly similar performances on all six constraints.

Table 4. Directionality Constraints for 16 Native French Speakers: Descriptive Statistics.

Statistics	**Initial Sonority (IS)**	**Final Sonority (FS)**	**Final Consonant Number (FCN)**	**Initial Consonant Number (ICN)**	**Vowel Quality (VQ)**	**Vowel Nasality (VN)**
Means	3.15	3.3	3.79	3.58	3.87	3.46
Standard Deviations	0.4	0.6	1.1	0.9	0.4	0.6

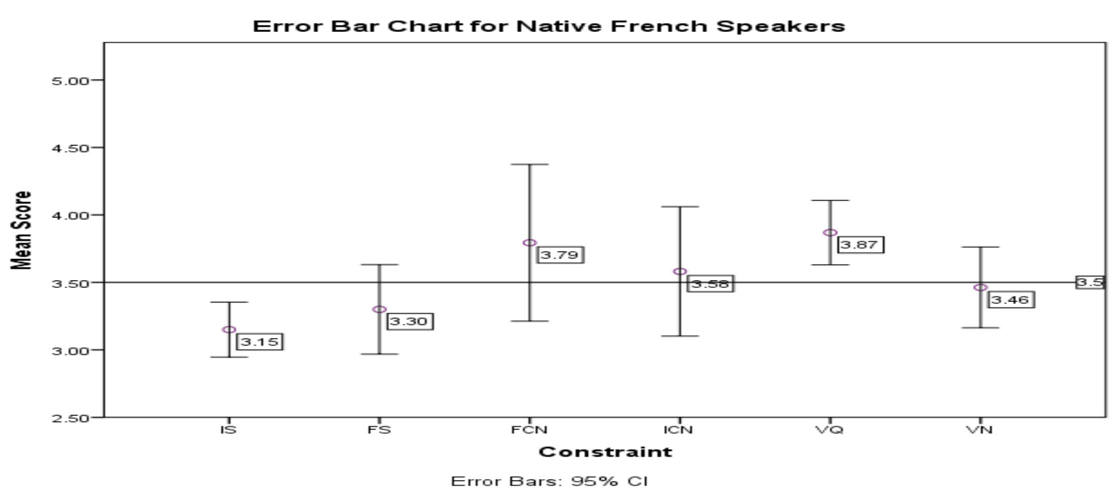

Figure 9. Directionality Constraints for 16 Native French Speakers: Error Bar Chart

In addition, there was no main effect of Condition, however, the interaction between Constraint and Condition did reach significance ($F(5,75) = 2.5$, $p = .04$, partial eta squared = .14, power = .76). The post-hoc Tukey LSD test revealed that the mean rating for FS in the reduplicative condition was statistically different from the mean rating for FS in the conjoined condition ($p = .01$). In the conjoined condition, French natives had a higher score than in the reduplicative one for FS, which is illustrated in Figure 10. No other significant differences were found.

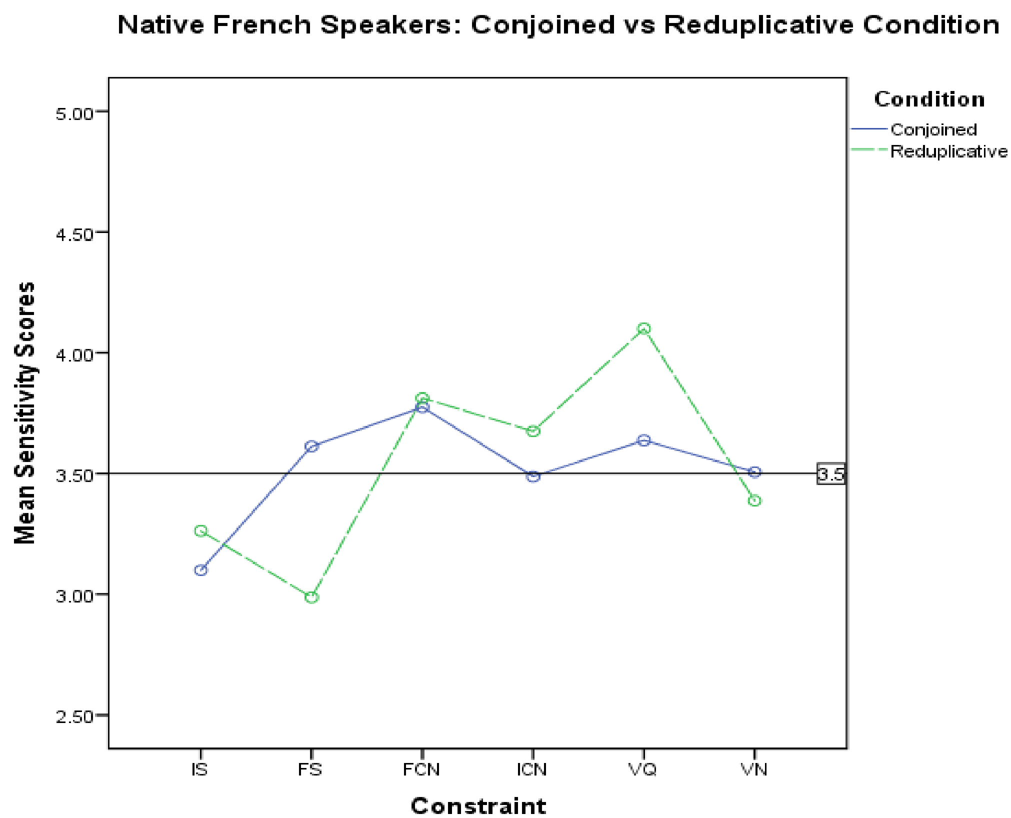

Figure 10. Native French Speakers: Conjoined vs. Reduplicative Conditions.

4.2.2. French non-native speakers. This group of participants consisted of 16 non-native French speakers who were all native speakers of American English.

The first analysis was the same as for all the previous groups, comparing the means to the level of indifference, defined as 3.5. The analysis revealed that the means of three constraints were statistically different from 3.5: FS (t = - 2.06, p = .04), FCN (t = 3.9, p= .0002), and VQ (t = 3.48, p= .0008). Recall that both native French speakers and native English speakers were sensitive to VQ. The fact that this group of participants, who spoke both English as a native and French as a non-native language, was sensitive to VQ, is not a surprise. Also, their high score on FCN is not unexpected, since native English speakers seem to be sensitive to this constraint as well. But the statistically significant score for FS was unexpected: first of all, neither native speakers of English nor native speakers of French had a strong preference for FS. Second, non-native French speakers seem to have an even lower mean than native French speakers for this constraint (3.13 vs 3.3 respectively). The descriptive statistical data for 16 non-native French speakers is displayed in Table 5, and the error bar chart is given in Figure 11.

When the six constraint means were compared to each other, the main effect of Constraint reached statistical significance (F (5, 75) = 4.8, p = .001, partial eta-squared = .24, power = .97). The post hoc Tukey LSD test revealed the following statistical differences among the constraints: the results for IS were significantly different from FCN (p = .02) and from VQ (p = .05), and the results for FS were significantly different from FCN (p = .001), from ICN (p = .002), from VQ (p= .004), and from VN (p= .002).

Table 5. Directionality Constraints for 16 Non-Native French Speakers: Descriptive Statistics.

Statistics	**Initial Sonority (IS)**	**Final Sonority (FS)**	**Final Consonant Number (FCN)**	**Initial Consonant Number (ICN)**	**Vowel Quality (VQ)**	**Vowel Nasality (VN)**
Means	3.56	3.16	4.14	3.68	4.07	3.76
Standard Deviations	0.4	0.6	0.9	0.4	0.8	0.6

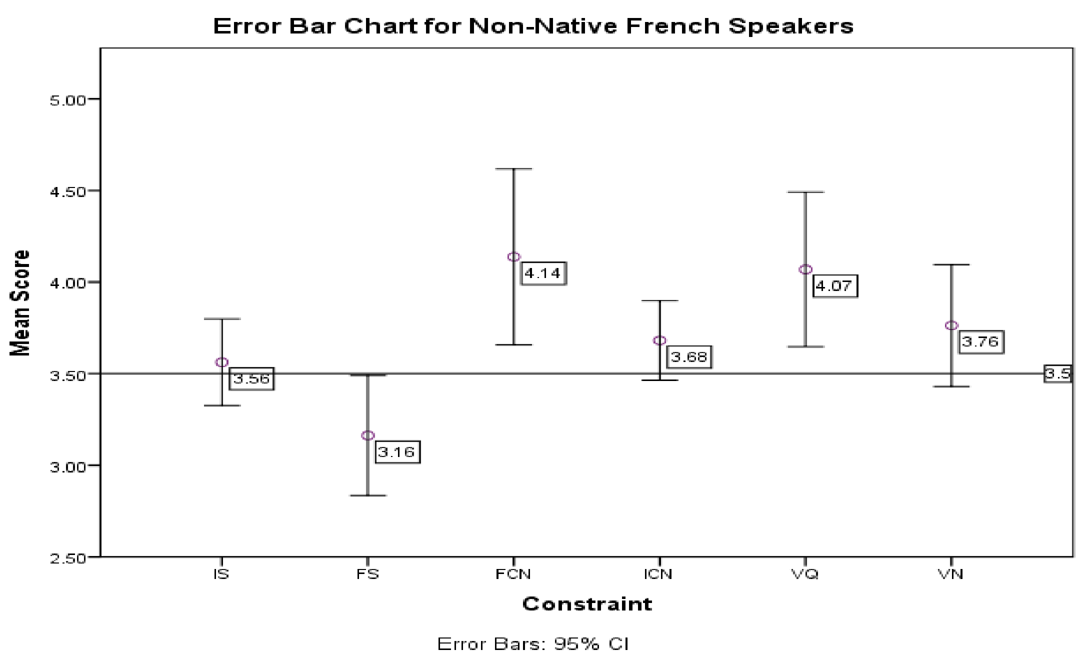

Figure 11. Directionality Constraints for 16 Non-Native French Speakers: Error Bar Chart

For the purposes of comparing the performance of non-natives French speakers to the performance of native French speakers, a mixed model analysis was performed, with the within-subject factor of Constraint and the between-subject factor of Proficiency Group. There was no main effect of Proficiency Group, or interaction between Constraint and Proficiency Group found. In Figure 12 a graphical representation of the performances of native and non-native French speakers is given. Although IS reveals an opposite directionality for French natives and non-natives, overall, the performances of the two groups are not significantly different.

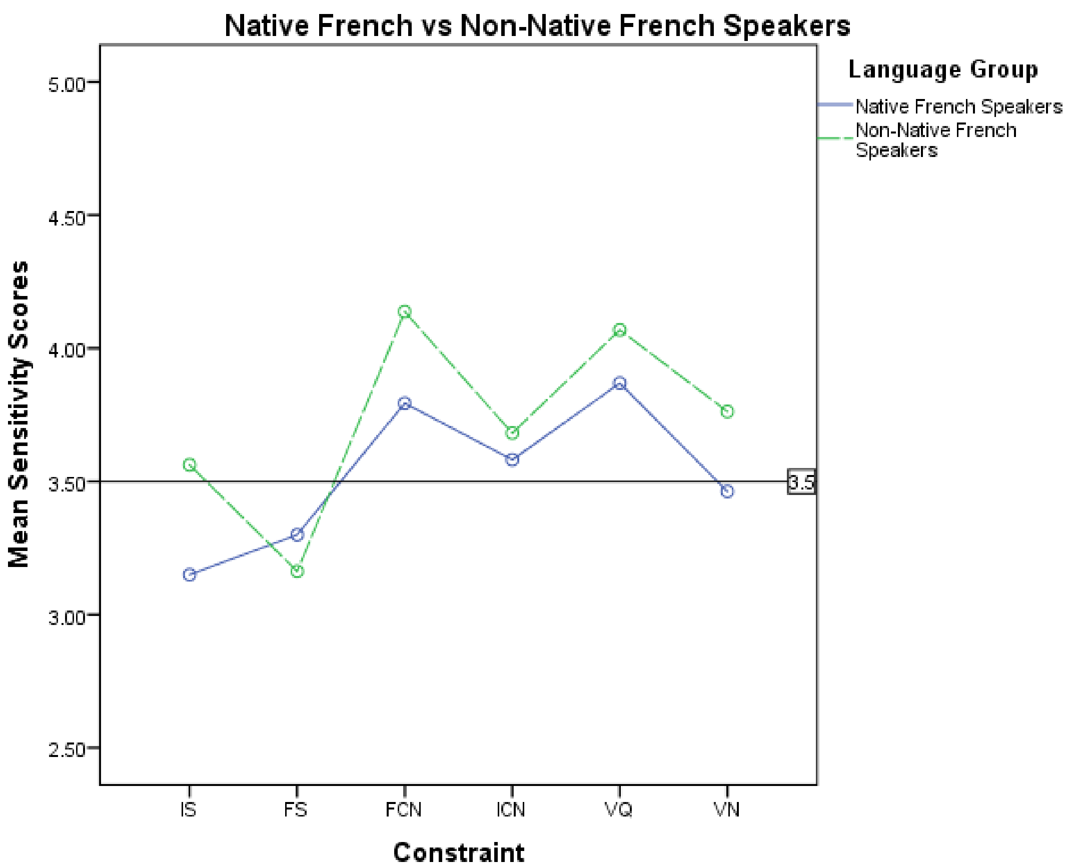

Figure 12. Directionality Constraints: Native vs. Non-Native French Speakers.

4.3. Discussion. One objective of this study was to test how sensitive speakers are to the putative Directionality Constraints. While these sensitivities might be expected to differ crosslinguistically, one major common finding among the four groups in our study was the sensitivity to Vowel Quality; this result is consistent with previous studies and it corroborates the hypothesis that the constraint on vowel quality may be active in a variety of languages. Another constraint that <u>most</u> groups were sensitive to in this experiment was Final Consonant Number. This is a notable finding, because since the day Cooper and Ross published "World Order" in 1975, the challenge has been to demonstrate with statistically significant results that speakers indeed prefer more final consonants in the <u>second</u> position, contrary to what Cooper and Ross initially said. This study corroborated the results of previous experimental studies (Birdsong, 1979), with statistically significant results for three groups out of four.

English native speakers stood out, as might be expected, as the most "sensitive" group. Three constraints out of six were statistically different from the threshold of indifference (compare this to two out of six for French natives and one out of six for English non-native speakers). This finding could be interpreted as the confirmation that binomials in English have a special status: not only do they seem to be more numerous than in French, they also tend to exhibit more systematicity in their phonological patterns, which leads to stronger preferences in native English speakers.

Also, this study showed that there are two constraints for which the directionality may be opposite in French and English; those constraints are Initial Sonority and Final

Sonority. The statistical results are not robust; therefore, no definitive statement can be made regarding sensitivities to sonority. Nevertheless, the mild trends that have been recorded are interesting and should be examined in a more detailed way in the future.

Finally, another important contribution of this study is the investigation of the possible differences between reduplicative and conjoined conditions. The analysis showed that Condition on its own does not have a strong impact on the sensitivity scores, which means that on average speakers treat the two conditions – reduplicative and conjoined - in a similar way. One interaction effect that was found for Final Sonority in the French sample will be discussed in 4.3.8.

Regarding constraints on word order in binomials, the most foundational question is: “Why would speakers prefer to place one constituent before another?” In section 2 I already discussed the answers to this question that have been proposed before. In what follows, I investigate what the answer to this question may be based on the results of my study and previous studies, and I discuss it in a constraint-by-constraint fashion. Specifically, I examine several factors that may all interact and contribute to speakers’ intuitions on the felicity of a particular order.

First, it will be shown that preferences for most putative constraints could be accounted for with an unmarked-before-marked principle. Second, I will also incorporate into my discussion, where it is appropriate, other factors that may influence speakers' intuitions, such as edge effects, sound symbolism, perceptual salience, and differences between metrical systems of French and English.

4.3.1. Initial Sonority. The most important finding of the present study for IS is that native English and native French speakers tend to display opposite directionality of preference for this constraint. English speakers on average prefer a more sonorant initial consonant in the first constituent (although the result is not statistically significant), and French speakers on average prefer a more sonorant consonant in the second constituent (the result is at the threshold of significance). What is more, in Birdsong’s (1979) study the same basic difference between French and English speakers was found; although his results for English native speakers were statistically significant, and his results for French native speakers were not. In terms of <u>statistical significance</u>, then, this study and Birdsong’s study have divergent results, but in terms of <u>general directionality preferences</u> the results are similar. It is worth noting that the two studies differ in several ways, such as sample size, experimental items’ structure, etc.

As for L2 learners' intuitions, English learners from various backgrounds performed similarly to native English speakers on this constraint, while French learners, who were all native speakers of English, had a higher score than native French speakers, although no main effect of Proficiency Group was found (see Figure 12). It is possible to speculate that French learners may have used their native English directionality preferences on French exemplars, though they were quite conservative in their judgments, as their mean score ended up being quite close to 3.5. Note that in French exemplars, due to the impossibility of stressing the first syllable, all the items were stressed on the second syllable (e.g., *div**otte**-liv**otte***), which is, as I have pointed out before, suboptimal, because the contrast that participants heard was not in a perceptually salient position. In English exemplars the stress always occurred on the first syllable, conforming to the main rhythmical pattern in English (e.g., ***wi**scow and **bi**scow*). This metrical difference between French and English test items might underlie French L2 learners' less pronounced sensitivity to IS with the French exemplars. Note that IS was the only constraint, on which they diverged from native speakers of French in terms of directionality; see Figure 12. The question remains why English and French native speakers tend to have divergent intuitions for IS.

A short-before-long hypothesis, whereby the shorter constituent precedes the longer one, is not satisfactory. In Birdsong's study two correlates of length were examined: 1. the duration of the initial consonants and 2. the effect of the initial consonant on the following vowel. When the duration of initial consonants of English nonsense words was measured, Birdsong found a tendency toward <u>a longer</u>, not shorter, consonantal segment in the first position. Thus, for example, in *lesh-gesh*, the duration of /l/ was 80 ms, and the duration of /g/ was 65 ms, and in *yickety-kickety* the duration of /j/ was 80 ms, while the duration of /k/ was 65 ms, etc. This is clearly at odds with the short-before-long principle, which predicts the reverse. On the other hand, the effect of the initial consonant on the following vowel, although it is more consistent with the short-before-long principle, is also not particularly convincing. Based on the study of Peterson and Lehiste (1960), the following hierarchy of English consonants in terms of their effect on the duration of the following vowel was proposed, from shortest to longest:

(25.) z m s b n p,d g,f v t k

As Birdsong rightly notes this hierarchy does not include consonants like *h, l, w, r*, which were used extensively as initial consonants in the first constituent, both in his study and in the present study. With respect to the consonants that are included in the hierarchy given above, their order is not always in line with the sonority hierarchy (from more sonorant to more obstruent as in (20)).

Clearly, the short-before-long bias may not be the best way to explain speakers' intuitions for IS. Another possible way to account for IS directionality preferences is to consider the unmarked-before-marked principle. Both unmarked-before-marked and short-before-long principles could be seen as consequences of cognitive processing preferences. Bock (1982) argued that sentence structure may to some extent mirror general processing demands. She appealed to studies on word retrieval, tip-of-the-tongue phenomenon, and sentence recall to provide evidence that “retrieval of words during sentence formulation influences sentence form, partially independent of the sentence intended substance” (p. 39). An important part of Bock’s argument is the claim that certain words are more accessible and easier to retrieve that others. For example, on a lexical-semantic level, words referring to concrete objects and events are easier for retrieval. On a phonological level, words that are shorter and lighter are easier for retrieval, and therefore, may be produced before other words. With respect to binomials, it has been observed that many of the putative Directionality constraints are in line with this argumentation; thus, both ICN and FCN predict that the first constituent will contain less phonological information than the second.

By the same logic that short, frequent and light elements are sequenced before long, infrequent and heavy ones, unmarked elements should be sequenced before marked ones, if speakers are sensitive to markedness. Sobkowiak (1993) claims that unmarked-before-marked "is a very potent principle determining the order of compounded elements" (p. 393). He further lists the differences between marked and unmarked segments, such as that marked segments are less frequent both intralinguistically and crosslinguistically, and that children tend to first acquire the unmarked segments of their ambient language and only later do they master the marked ones. Since we are dealing with onsets, it is necessary to recall what types of onsets are considered unmarked. The markedness of onsets tends to correlate with their status on the sonority scale. The most unmarked onsets are obstruent and the most marked onsets are sonorant consonants, based on the onset markedness hierarchy, given below (Prince & Smolensky, 2004):

(26). ONS/O >> ONS/N>> ONS/L

Thus, a nonsense item from my French test like *divotte-livotte* has the first onset unmarked and the second onset marked, which complies with the unmarked-before-marked principle. French intuitions can then be reasonably well explained by the unmarked-before-marked principle. English is a harder case, since the predicted order appears to be at odds with this principle. This fact begs for an explanation.

At this point, it is necessary to summarize Sobkowiak's 1993 corpus study, in which he also pointed out the same fact: the predicted order in English binomials for IS seems to contradict the unmarked-before-marked hypothesis. He compiled a corpus of both conjoined and reduplicative English binomials and examined the frequency of obstruent and sonorant consonants in the onsets. A few interesting facts emerged from his analysis of reduplicative pairs: it appears that only certain sonorant consonants were overrepresented in the onsets of the first constituent, such as /h/ and /r/. It has been noticed by many linguists that /h/ is the most prototypical onset consonant of the first constituent of the rhyming binomials (e.g., *hurly-burly, hanky-panky, hustle-bustle*). Indeed, while the overrepresentation of /r/ is harder to explain, /h/ seems to be a good choice for a number of reasons. Sobkowiak notes, for instance, that the tendency "to maximally reduce the amount of oral gesture" (p. 408) goes well with the principle of reduction of phonetic material in the first constituents (Birdsong, 1979; Cooper & Ross, 1975). The consonant /h/, apart from being the most sonorant (after the glottal stop), has also been described as the most vowel-like, with the least amount of consonantality, measured as the presence of frication or obstruction in the vocal tract. As "the least consonantal", /h/ may be an excellent contrastive sound for most other consonants, even those that are [+sonorant], but involve more articulatory effort. Moreover, this contrast will be best perceived, if the constituents are sequenced in the predicted English order. Thus, Huber (1974) pointed out that /h/ in the word-initial position is less likely to become perceptually lost than in the middle of a multisyllabic word (as cited by Birdsong, 1979, p. 93). In the initial position /h/ will be produced with more breathiness (Pierrehumbert & Talkin, 1992), and therefore, will be more perceptually salient than elsewhere in the signal. The preliminary conclusion at this point seems to be: IS in English does not comply with the unmarked-before-marked bias, because sonorous consonants (and here I am talking mostly about /h/) need to be in a perceptually salient position, so that their contrast with the following obstruent onset is well perceived.

But let us return to Sobkowiak's study. His corpus analysis showed that sonorants, as a class, are actually significantly more frequent in the onsets of the second constituent than in the first one, with the two exceptions already mentioned, /h/ and /r/. Specifically, in his corpus 324 (31.6%) binomials had an initial sonorant consonant in the first slot, while 408 (39.7%) binomials had an initial sonorant consonant in the second slot. This finding does not necessarily refute the hypothesis on IS directionality; for example, in reduplicatives like *holly molly* and *hobnob* the second onsets are [+ sonorant], however, these words still comply with the predicted order, because the first onset is even more sonorant than the second. Also, there seems to be an independent labiality factor, which favors labial consonants (including a very sonorant /w/) in the second place, according to the author. Consonants that were overrepresented in the onset of the second constituent in Sobkowiak's corpus were /p,b,d,ʤ,m,w/, all of which are [-sonorant], except for /m/ and /w/ which are labial. Sobkowiak's final conclusion was that despite the initial impression that English word order is not conforming to unmarked-before-marked principle, a more careful look at his corpus revealed that marked consonants are actually more frequent in the onsets of the second constituents. By marked Sobkowiak means sonorants as a class and labials as a class. This conclusion does not seem satisfactory: the fact that very sonorant /h/ and /r/ are overrepresented in the first onset and very obstruent /d, ʤ/ are overrepresented in the second onset cannot be well explained by unmarked-before-marked principle. Interestingly, in Birdsong's study the highest means were obtained for the exemplars *rasby-dasby* (4.7500) and *haipo-daipo* (4.3125). Both of these items start with either /r/ or /h/, and have a /d/ as a second onset.

My English data did not reach statistical significance for this constraint, but this does not refute the hypothesis that English native speakers are sensitive to IS. The sample size of the present study was rather small, and further, there are other studies in which statistically significant results for IS were achieved (Birdsong, 1979). However, Sobkowiak may be right when he says that lability could be a confounding variable. Labiality of the second onset has been noticed before in crosslinguistic investigations (Jakobson & Waugh, 1987). In Russian, for example, several reduplicative binomials have labial consonants in the second element (e.g., *shury-mury, tary-bary, shurum-burum*). In the future studies labiality should be taken into consideration in hypothesis formulation and in development of corresponding experimental items.

To summarize, the present study showed that IS should be tested with more scrutiny in the future; a major finding was that English and French native speakers tend to have opposite directionality preferences on this constraint. French directionality preference appears to comply with the unmarked-before-marked principle, but English directionality preference cannot be simply accounted for neither by the short-before-long nor by the unmarked-before-marked principles. Rather, several factors may be at work.

Labiality may be an important consideration; if indeed labial consonants are preferred in the second position, then this pattern could be explained by the unmarked-before-marked principle, such as in *teeny-weeny*. When, on the other hand, labiality is not a part of the equation, the preference for the more sonorant consonant in the first position may be accounted for by perceptual salience argument: sonorant consonants (especially the most frequent and the most sonorant /h/) tend to be less distinctive when placed in the middle of a binomial phrase. Thus, the phrase-initial position for /h/ may be necessary for creating a clear contrast between the two onsets; this sharp contrast may be what speakers associate with expressiveness in rhyming binomials. Finally, a special status of /h/ and possibly /r/ needs to be further examined in the future; if speakers are highly sensitive to the IS only in cases that involve /h/ or /r/ as the first onsets, then sonority as a global principle may be reevaluated.

4.3.2. Final Sonority. For this constraint, native English speakers' preferences were slightly above the level of neutrality, while all other groups were below it. The most intriguing finding was that the non-native French speakers (native speakers of English) this time did not exhibit any trace of their English intuitions on the French exemplars, since their mean score was even lower than the one for the native French speakers (see Figure 12).

Clements (1990) proposed that the most unmarked syllable crosslinguistically is a CV syllable, where sonority rises sharply towards the peak and falls minimally towards the end. Therefore, sonorant codas are the least marked codas. If we appeal once again to the unmarked-before-marked principle, the French observed order seems to be the "correct" pattern, while the English pattern appears not to conform to the principle. Interestingly, the same situation was observed for IS, where the French preferences seemed to follow the unmarked-before-marked principle, and the English preferences seemed to go against it. Naturally occurring binomials that instantiate FS in English are not very numerous, especially in comparison with IS. Some of the most notable ones are listed in (8). The mere fact that binomials exemplifying final sonority are not very common in English may mean that native English speakers would not have well shaped intuitions for FS. This may be the reason why native English speakers' score for FS did not reach statistical significance on the English test, and also why they did not apply their English intuitions to the French exemplars, but rather, chose the "default" pattern of unmarked-before-marked.

As subtle as the intuitions are, they need to be explored in more detail. Let's consider the short-before long bias and its potential to account for the English word order. The principle predicts that the second coda of a binomial would be longer than the first one. In terms of the inherent duration of consonants, one observes that continuant consonants are generally longer than stops. Also, the effect of the consonants on the preceding vowels should be taken into account as well; as a general rule, vowels are longer before voiced consonants and shorter before voiceless ones. Birdsong used Klatt's (1979) hierarchy of VC# duration (reproduced below) from shortest to longest (as cited in Birdsong, 1979, p.73):

(27).	(t,k)	p	n	m	(d,g)	b	(f,v)	(ʃ,s)	z
Ms =	135	155	155	175	185	200	220	225	235

In spite of the fact that not all consonants are present in (27), the picture that emerges from this hierarchy is that continuant consonants are the longest, both in terms of their inherent duration and their effect on the preceding vowel. Although many sonorant consonants are continuous (e.g., /r/, /l/, /w/), the presence of [+cont] feature in a consonant does not necessarily signify the presence of a high degree of sonority. For instance, /s/ is one of the acoustically longest consonants, however, it is fairly low on the sonority scale. It appears that the short-before long bias may not be the best account to use for justifying the order in English binomials. Thus, based on the hierarchy in (27), we would expect the order *sane and safe* to be more felicitous than the reverse, yet, this order is not the preferential one.

What is remarkable for both constraints discussed so far, is that in English the more sonorant consonant is preferred on the edges – on the left edge for IS and on the right edge for FS. Word-initial and word-final positions are considered the most prominent positions; this is where the perceptual salience of segments will be enhanced (Côté, 2000). For the reasons that remain unclear so far, native English speakers tend to prefer more sonorant consonants in presumed perceptually salient positions, while French native speakers do not.

To summarize, the preferential order for FS in French could be accounted for by the unmarked-before-marked principle, which is the same observation that I made for IS.

In English, once again, the situation is quite a bit more complicated. English order is at odds with the unmarked-before-marked bias, and the short-before-long principle is not a strong explanatory factor either, since the duration of a segment may be more linked to the feature of continuancy rather than sonority. Perhaps the most important feature of the English word order is that the more sonorant consonants are preferred on the edges of a binomial phrase, and not in the middle of it. This putative tendency of emphasizing sonority and deemphasizing obstruency should be investigated in more detail in future studies.

4.3.3. Final Consonant Number. FCN seems to be one of the constraints that most participants comply with. However, for most groups a high mean for FCN was coupled with a relatively large standard deviation, which points to the inconsistency of intuitions inside the groups. Nevertheless, only one group of the respondents had an FCN mean score that was not significantly different from 3.5, and that was native French speakers.

Similarly to the case of FS, binomials that exemplify FCN in English are not particularly common, and I am not aware of any French binomials for FCN. This observation alone leads me to believe that the heightened sensitivity that speakers exhibited for this constraint could be explained not necessarily by their experience with natural binomials, but by other factors. Specifically, I argue that speakers attend to length, markedness, and relative perceptual salience of the segments in the codas.

The same principles that were already discussed, such as short-before-long and unmarked-before-marked could be applied for this constraint as well. Both markedness and length seem to conspire and predict that speakers would comply with FCN. Indeed, since an item with a complex coda is both more marked and longer in terms of the quantity of its segments, it is not surprising that FCN stands out as a constraint that has a relatively high mean across most groups.

However, the large standard deviations that I observed may indicate that there might be a conflicting factor. I hypothesized that this factor is the perceptual salience of the coda. Perceptual salience is the concept that was developed in studies of Steriade (1999) and Côté (2000), among others. Côté formulates the following principle of perceptual salience (135):

(28). All segments are perceptually salient.

Further, she continues: “The perceptual salience of a segment - or its degree of confusability with zero – is a function of the quantity and quality of the auditory cues that signal its presence in the speech stream. The best cues to consonants, apart from those present in the consonants themselves, are found in the neighboring vowels, especially in the CV transition” (p. 136). There are several empirical generalizations that Côté summarized in her work and that condition the application of consonant deletion or vowel epenthesis. Two of these generalizations, which are relevant to my discussion, are given below:

(29). a. Consonants that are relatively similar to a neighboring segment want to be adjacent to a vowel, and preferably followed by a vowel.

b. Consonants that are not at the edges of prosodic domain want to be adjacent to a vowel, and preferably followed by a vowel.

Recall that all the items for FCN were designed in such a way that the two consonants of the complex coda were of the same class in terms of sonority – either both stops or both fricatives. That means that all the last consonants in the complex codas were "relatively similar to a neighboring segment" (see (29) a.). Let's consider the example like *seroap-seroapt*. In the reduplicative condition, the unpredicted order would be particularly undesirable, since in *seroapt-seroap* the consonant /t/, sandwiched between two other consonants (/p/ and /s/), would be in a perceptually unfavorable position. This means that the consonant /t/ in *seroapt-seroap* "wants" to be followed by a vowel, which does not happen in the reduplicative condition, but does happen in the conjoined one for English items, where the conjunction *and* starts with a vowel. The predicted order *seroap-seroapt* would be slightly more favorable for the perception of /t/ since in this consonant would be on the edge of a prosodic domain, which is a more salient position than inside the prosodic domain (see (29) b.).

Given the considerations explained above, it would be reasonable to expect a difference between conditions - reduplicative and conjoined - in this particular case, at least in English (in French the conjunction *ni* starts with a consonant, therefore, the difference between the two conditions is hypothesized to be less important). In other words, it would be unsurprising to see that participants chose the unpredicted order more often in the conjoined condition, than in the reduplicative, because in the former condition the complex coda would end up next to a vowel, which would increase the perceptual salience of the second consonant (i.e., *seroapt-seroap* vs *seroapt and seroap*). In order to check if the large standard deviation for FCN could be a byproduct of the differences between the two conditions, I looked at the comparison of reduplicative and conjoined conditions for FCN (see Figure 6). Unfortunately, the means for FCN for both conditions are very close to each other. Thus, I was not able to confirm my hypothesis that the large spread of data observed for FCN is due to the differences in judgments in two conditions, where the relative perceptual salience of the coda appears not to be equal. Accordingly, what causes the spread of the data to be so large remains unclear for the moment.

In sum, FCN seem to be a strong constraint overall. However, French native speakers were less sensitive to it than other groups, and the cause of the large standard deviations remains not well understood. Both of these issues need to be addressed in future research.

4.3.4. Initial Consonant Number. Only Native English speakers tend to be sensitive to ICN. Even on the French test, native English speakers were slightly above the native French speakers, which may be interpreted as a mild influence of their native language, where this constraint seems to be strong. Similarly to the case of FCN, both unmarked-before-marked and short-before-long principles align and predict the order where the second element has more consonants. Indeed, complex onsets are more marked than simple onsets, and more initial consonants result in a longer string of segments.

The main difference between FCN and ICN is that the respondents exhibit more sensitivity to FCN than to ICN across all four groups. I hypothesize that sensitivities to ICN may be weakened by the edge effects, which predict that a consonant cluster is better suited for a position on the edge (left or right) than a phrase-internal one. To illustrate the different behavior of consonants on the right and left edges, Côté (2000) writes: "Consonants at the right and the left edges behave differently; both edges benefit from the cue enhancement, but through different processes. The right edge is mainly associated with segment lengthening, but is not characterized, or only marginally so, by articulatory strengthening. By contrast, the left edge involves articulatory strengthening (e.g., tighter constriction), with lengthening apparently playing a secondary role in that position" (p. 146). Based on this observation, the conclusion that I would make is that edge effects constraints are not in conflict with FCN, but they are in conflict with ICN. A longer and a more complex string of consonants is preferred on the edges, either left or right. For ICN the complex onset would be in the middle of the binomial expression, if sequenced in the predicted order, and therefore would not benefit from an increased articulatory strengthening. This discrepancy may be the reason why speakers across four groups have much lower means for ICN than for FCN. English native speakers may be more sensitive to this constraint because they have a sufficient number of binomials that exemplify ICN in their language. However, even native English speakers in my study were more sensitive to FCN than to ICN, and the reason for that may reside, as I have argued, in the conflict between ICN and the edge effects.

4.3.5. Vowel Quality. This constraint appears to be the strongest across the four groups. The alternation of vowels contrasting in quality in conjoined binomials, ablaut reduplicatives, and other linguistic structures has been well-documented, and several explanatory factors have been proposed to account for the preferred order (Birdsong, 1979; Cooper & Ross, 1975; Minkova, 2002). This study provided additional evidence that speakers of both English and French have a relatively strong preference for high and front vowels sequenced before low and back vowels.

In case of VQ it is highly probable that many factors align in the same direction. Similarly to the previously examined phonological constraints, the principles of unmarked-before-marked and short-before-long could be applied to VQ as well. But for this particular constraint phonoiconicity is usually considered a big part of the equation. The phonaesthetic correlation between vowel height and semantics has been noticed and described by many scholars (Jespersen, 1942; Minkova, 2002; Pinker, 1995; Southern, 2000). The association of high vowels with such qualities as smallness, lightness, short distance, and low vowels with large size, heaviness and long distance may be grounded in the way those two vowels are pronounced, with a smaller articulatory gesture required for high vowels, and a larger one for low vowels. Another related curious phenomenon: several cross-linguistic studies in phonosemantics of deictics pointed to the fact that words like “this” and “here” contain higher vowels than their counterparts, “that” and “there” (Tanz, 1980). Deictic words in both French and English exhibit these iconic mappings, which may strengthen speakers' associations of *i* with proximity and *a* with distance (English: *this, here, near* contrasted with *that, there, far*; French: *ici* contrasted with *là*). Commenting on the role of iconicity in ablaut reduplication, Minkova (20002) writes: “This iconicity is instrumental in sustaining and recreating the original template” (p. 142).

Iconicity aside, there are other factors that could explain the directionality preferences for VQ which should be considered. Minkova (2002), for example, described ablaut reduplicative words as verbal art products, where prosody and expressive phonology are the motivational factors for both the choice of particular segments and their linear order. Recall that in Minkova's work a general constraint of INTEREST was proposed, which was formulated as follows:

(30). INTEREST: BR maintain maximal perceptual distance

The idea of a sharp contrast between the two constituents is an important one to keep in mind. Clearly, the two elements are distinct from each other in most binomials (except for those that are exact copies of each other), but how distinct they are, and on what dimension they are distinct – those are important questions. Minkova's claim was that the two vowels in ablaut reduplication have to be maximally distinct from each other on the dimension of height and phonetic duration. Minkova concludes that /I/ and /æ/ are the ideal candidates for expressing these contrasts in English, and the linear order from /I/ to /æ/ is a by-product of prosodic preferences, which link phonetically longer segments with phrase-final positions. Interestingly, Birdsong (1979) argued that height and phonetic duration may be collapsed into one constraint, because for his experiment height and duration were the strongest predictors of speakers' preferences, and furthermore, they also correlated with each other. Thus, once again, the idea that height and phonetic duration are two sides of the same coin seem to be expressed in Minkova work as in Birdsong's.

Recall that in the present study another pair of vowels was used, namely the *e-o* alternation, which represents a different dimension of vowel quality, advancement. Although less common in natural binomials, advancement is also hypothesized to be an important piece of acoustic information that speakers use when sequencing the constituents of binomials (Oakeshott-Taylor, 1984). The sequencing preference of front vowels before back vowels could be motivated by the same factors as discussed before.

First, the iconicity factor has been proposed to account for the intuitions of speakers to place front vowels before back vowels. In cognitive poetics, for example, back vowels are often described as “darker” and front vowels as “lighter” (Tsur, 1992). To this point Tsur (1992) writes: “...poets may use more frequently words that contain dark vowels, in lines referring to dark colors, mystic obscurity, or slow and heavy movement, or depicting hatred and struggle. At the reception end of the process, readers have vague intuitions, that the sound patterns of these lines are somehow expressive of their atmosphere” (p. 190).

Second, the unmarked-before-marked principle may also be relevant for vowel advancement. *O*-like vowels are more marked crosslinguistically because they are labial.

Alderete, Beckman, Benua, Gnanadesikan, McCarthy, & Urbanczyk, S. (1999) proposed the following markedness hierarchy which shows that labial vowels are indeed the most marked:

(31). *Pl/Lab >> *Pl/Cor >> *Pl/Phar

To summarize, this study has shown that VQ may be the strongest constraint crosslinguistically. I have argued here, that this might be because several factors, such as phonoiconicity, the unmarked-before-marked, and the short-before-long seem to all predict the same order. Finally, note that native English speakers showed the highest degrees of sensitivity to VQ, possibly because ablaut is a phenomenon that is particularly frequent in Germanic languages (Minkova, 2002; Southern, 2000).

4.3.6. Phonological Vowel Length. Theoretically, the putative VL constraint could be accounted for by both short-before-long and unmarked-before-marked principles. In practice, these principles do not always seem to be relevant to speakers. Specifically, in this study the intuitions on VL were weak, which I explain by the choice of vowel oppositions (/I/ vs /i/ and /U/ vs /ʊ/) and word structure (disyllabic, with the stress on the first syllable). The vowels chosen may not be sufficiently different from each other in terms of quality, while the specific word structure did not allow to match the long /I/ with an absolute word-final position.

Indeed, this study did not provide convincing evidence that speakers or learners of English have strong intuitions pertaining to the phonological length of the stressed vowels and its impact on the ordering preferences. Recall that Minkova (2002) claimed that reduplication involving vowels that differ in moraicity would be prohibited. However, a few conjoined binomials in English exhibit this pattern (see (6)), which is why a constraint on VL has been formulated in previous studies.

This constraint has been tested before, namely, Birdsong's study (1979) showed that VL for both English and French is a strong constraint (statistically significant results were reached). However, there are important differences between Birdsong's study and this study. Not only was Birdsong's sample larger, but also experimental items were designed differently. For example, items like *smats and smates,* where the second vowel tend to diphthongize for most American speakers, were used in some of his English exemplars, while in this study I tried to stay away from using diphthongs with the purpose of isolating quantity of vowels from quality to the maximum. Only two alternations were used in my study: /I/ vs /i/ and /U/ vs /ʊ/, because those two alternations were considered the most appropriate for my goals, since the qualitative difference between /I/ vs /i/ is, arguably, less strong, as the qualitative difference between amonophthong and a diphthong. Moreover, all of my items were disyllabic, unlike in Birdsong's study, where there was a mix of monosyllabic and multisyllabic items. In monosyllabic nonsense pairs like *grib and greeb* the need to align the long vowel /I/ with the phrase final position may be greater than in disyllabic words like *lister and leaster*, where the long vowel is not in an absolute phrase-final position.

Based on the results of this study, I would argue that native English speakers are sensitive to the <u>quality</u> of the stressed vowel (which explains their high means on VQ), but not so much to its quantity, if under quantity we understand phonological length. However, it is very plausible that in certain cases speakers may show more sensitivity to phonological length. Such cases include situations when the difference in length is accompanied by a significant difference in quality (a pairing of a monophthong and a diphthong), and / or when the constituents of a binomial are monosyllabic. Most English binomials that exemplify this constraint fall under one of these two cases, as shown below:

(32). *wax and wane, rant and rave, wet and wild, null and void, trick or treat*

Finally, it is worth mentioning studies on perception of /I/ and /i/, which have demonstrated repeatedly that native English speakers attend less to the quantitative durational differences between these vowels, and more to the qualitative differences, such as the distribution of energy in the spectrum (Kondaurova & Francis, 2008). The mere fact that the attention focus is on the quality for English speakers, may be indicative of the fact that durational differences between these vowels are, in fact, of a secondary importance in native speakers' grammar. With respect to their qualitative differences, although native speakers perceive them well, I argue that they are not sufficiently large to induce strong intuitions pertaining to the word order in expressive structures. Minkova (2002) may have been right when she proposed that the base and the reduplicate have to be perceptually distinct at the maximum (see (30)). This maximal distinction between two nuclei, expressed in highly contrastive height or advancement, may be a more familiar and a more iconic contrast, than the oppositions of vowels whose F1 and F2 are similar.

4.3.7. Vowel Nasality. Native speakers of French do not seem to have a preference for the binomial word order involving oral and nasal vowels. Thus, the hypothesis proposed by Couasnon (2012), was not corroborated by this study. Figure 9 clearly shows that VN was the only constraint for which the mean ended up being almost exactly at 3.5. This is particularly surprising, because nasal vowels are more marked than oral vowels, and they are also longer than their oral counterparts in both open and closed syllables (Delattre & Monnot, 1968); therefore, both unmarked-before-marked and short-before-long principles predict the same order.

There is one detail though, that is worth mentioning. Recall that one half of the items for this block were designed with an open final syllable (e.g., *gonais-gonin*) and the other half with the closed final syllable (e.g., *goudette-goudinte*). When I compared the scores for two conditions, open syllables vs closed syllables, I found that the mean rating for the open syllable condition was higher (3.85) than the one for the closed condition (3.07). Nevertheless, the difference between open and closed conditions failed to reach statistical significance ($t = 1.86$, $p = .08$). Accordingly, I cannot conclude that respondents were significantly more sensitive to VN in one condition than in the other, although they were slightly more sensitive to it in the open syllable condition.

In naturally occurring binomials there are very few that have oral-nasal alternations (e.g., *bel et bien, cahin-caha*). Arleo (2009) investigated ablaut reduplication in counting-off rhymes from several languages, and found that alternations involving nasal vowels are much less frequent than more traditional alternations involving high / front and low / back vowels in French nursery rhymes. Arleo (2009) gives a few examples from the corpus, such as *ajin-ajon*, *pin-pon* and *pin-pan*, where most often <u>both</u> vowels are nasal, but different in quality. Note again that the role of contrastive vocalic quality (height or advancement) seems to be crucial with respect to ordering the words in ablaut reduplicative structures. It would be incorrect to say that nasal vowels are identical in height and advancement to their oral counterparts. On the contrary, numerous studies have shown that nasals are on average less front than oral vowels, which acoustically correlates with a lower F2. Styler (2008) reports the results of the study by Delvaux, Metens, & Soquet (2002), where both MRI and acoustical measurements were used to compare French nasal vowels with their oral counterparts. It was found that /ɛ̃/ is less front than /ɛ/, /ɑ̃/ is more rounded and back than /ɑ/, /ɔ̃/ is more rounded than /ɔ/ (Delvaux et al. as cited by Styler, 2008, p.17). Figure 13 reproduces an illustration from Carignan's study (2014), which shows that the differences in quality between nasals and orals are quite complex and appreciable.

However, these qualitative differences may not be sufficient to create expressive contrastiveness between the two nuclei. The discussion of VQ has shown that qualitative changes in vowels are preferably maximal. The concept of a maximal perceptual distance between the two nuclei might be important specifically for expressive language. The contrast created by the juxtaposition of vowels differing in nasality in French seems similar to the contrast created by the juxtaposition of vowels differing in phonological length in English; this contrast may just not be “expressive enough”. Based on the evidence from this study, for playful binomial locutions with vowel alternations, vocalic differences in height and advancement appear to be preferred to differences in other dimensions, such as nasality.

It is interesting that non-native speakers of French were slightly more sensitive to VN than native speakers in the predicted direction, which might mean that they are sensitive to either the markedness, or the longer duration associated with vowel nasality. Nasality in English is only co-articulatory, and not phonemic, like in French.

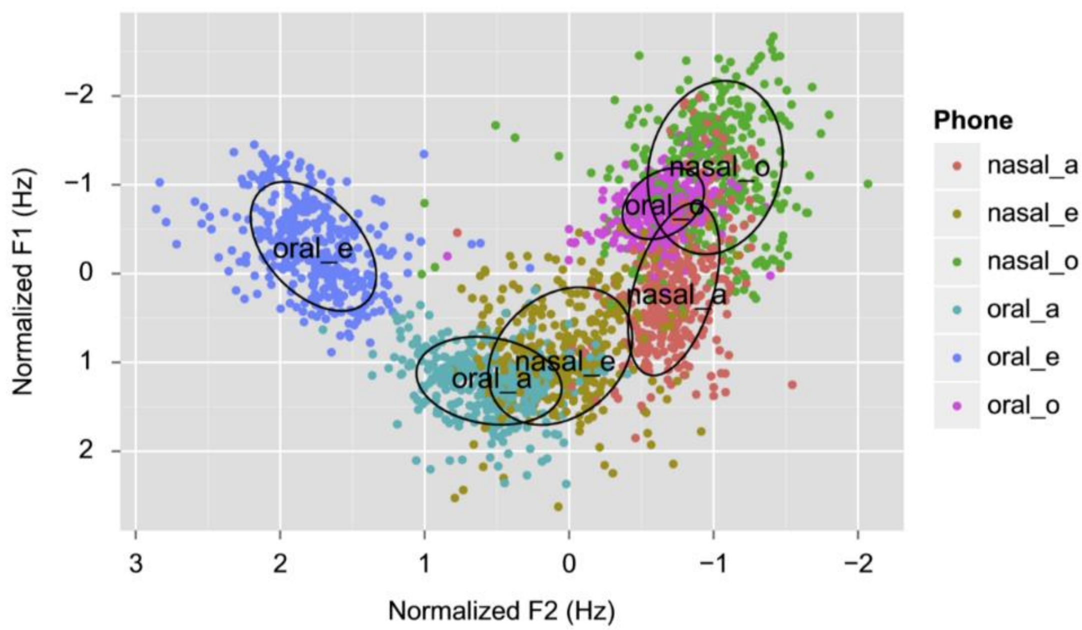

Figure 13. French Nasal and Oral Vowel Plot. Source: Carignan (2014).

Whether or not English speakers perceive nasality differently than French speakers is an interesting question. Delvaux’s (2009) perceptual experiments established that speakers (both francophone and anglophone) don't pay much attention to durational differences when discriminating between an oral and a nasal vowel. Rather, the reduction of the spectral prominence in F1/F3 and the lowering of F2 seem to be the cues that speakers use to distinguish between oral and nasal vowels. Thus, Delvaux (2009) writes: "...la durée ne constitue apparemment pas un indice perceptuel sur lequel se fondent *systématiquement* les auditeurs lorsqu'ils doivent décider si une voyelle est orale ou nasale" (p. 48). "…apparently duration is not a perceptual index on which listeners rely *systematically* when they must decide if a vowel is oral or nasal".[7]

Other studies, on the contrary, have emphasized the importance of duration as a perceptual cue (Delattre & Monnot, 1968). More studies are needed to determine whether francophone and anglophone speakers attend to different cues when dealing with nasality.

To summarize, it seems that nasality does not impact the order of the constituents after all. This is in line with my argument that height and advancement are the preferred dimensions to use for expressing a contrast between two vocalic nuclei. The authentic French nursery rhyme given below seems to be an excellent illustration of the relative acceptability of both orders, nasal before oral and oral before nasal:

(33)

Cahin-Caha!

Dame cane s'en va.

Caha-Cahin!

Dame cane s'en vient.

(*Trois petits canetons*)

[7] My translation

4.3.8. Conjoined and reduplicative conditions. The result of an RM ANOVA showed no main effect of Condition, neither for English nor for French, however, one significant interaction was found. As a reminder, this interaction was detected in the French sample: French native speakers had a significantly higher mean rating for FS in the conjoined condition (see Figure 10). When I looked at each experimental item's mean score for FS in French, I found that the range of mean scores in the reduplicative condition was 2.7-3.4 and the range of mean scores in the conjoined condition was 3.2-4.06. There were 2 items in the conjoined condition that received particularly high scores: *ni coubade ni coubaille* and *ni cadape ni cadaille*. Both of these items had scores of 4.06, which is above the threshold of indifference. Without these two items the mean for the conjoined condition would have been 3.29 and the range would have been 3.19-3.44, which is much closer to the reduplicative condition. The higher ratings for the two aforementioned items in the conjoined condition may have been accidental; however, I decided to investigate this pattern further.

Note that both items (*ni coubade ni coubaille* and *ni cadape ni cadaille)* have codas that differ in continuancy. The feature of [+continuant] was mentioned in the previous discussion in relation to the sensitivity to coda length. Specifically, it was noted that continuant consonants tend to be longer than stops, therefore, it is plausible that subjects may show more sensitivity to FS if the two codas are different in terms of continuancy. When I examined again the French items for FS, I noticed that among them five had codas that differed in continuancy (*cazille-cazibe*), and the other five had codas that did not differ in this feature (*talaique-talaime, ratalle-ratafe*). Furthermore, items that differed in continuancy of their coda seem to have larger means compared to the other half of the items. Below I have listed all experimental items for FS, with their mean scores, by Condition and Coda Type.

Table 6. French Experimental Items for FS, by Condition and Coda Type.

Condition	**Coda Type**	**Item**	**Mean Rating**
Reduplicatve	Same	*talaique-talaime*	2.69
Reduplicatve	Same	*ratale-ratafe*	2.69
Reduplicatve	Same	*chipane-chipague*	2.88
Reduplicatve	Different	*rinoule-rinoupe*	3.13
Reduplicatve	Different	*cazille-cazibe*	3.38
Conjoined	Same	*ni davaisse ni davaile*	3.19
Conjoined	Same	*ni tipame ni tipague*	3.44
Conjoined	Different	*ni rouzape ni rouzaille*	3.25
Conjoined	Different	*ni cadape ni cadaille*	4.06
Conjoined	Different	*ni coubade ni coubaille*	4.06

Note that in the conjoined condition I had three items that are different in Coda Type, but only two in the reduplicative condition. In order to check if Condition and Coda Type interact, I conducted an RM ANOVA, with the dependent variable of sensitivity score and 2 independent variables of Coda Type (different or the same) and Condition (reduplicative and conjoined). The analysis showed a significant main effect of Condition ($F(1, 15) = 5.8$, $p = .03$, partial eta-squared = .28, power = .62) and a significant main effect of Coda Type ($F(1,15) = 4.6$, $p = .05$, partial eta-squared = .28, power = .52), but no interaction between Coda Type and Condition. This is illustrated in Figure 14.

This means that both Coda Type and Condition independently have a significant effect on the ratings: in conjoined condition and with the codas different in continuancy speakers are more sensitive to FS and are more likely to sequence the constituents in the predicted (short-before-long) order. Note that these results do not necessarily invalidate the general trend in the directionality preference of native French speakers: the vast majority of the mean scores (see Table 6) are still below the level of indifference. Nevertheless, this is an important piece of the puzzle, which indicates that intuitions of French native speakers are less consistent than they may have appeared to be at the first glance.

The effect of both Coda Type and Condition make sense upon reflection. When the necessary contrastiveness in the length of the coda is present in the signal (when one coda is a stop and the other is a continuant), the judgments of the French speakers tend to be more in line with the short-before-long principle. Also, when the phrase is longer and contains more syllables (in conjoined condition), French speakers may be a little bit more inclined to highlight the final lengthening at the end of the long unit, by placing the constituent with the longer coda in the second position. But this trend, I argue, is mild, since the mean score for FS in the conjoined condition is just barely above 3.5. The differences between Conditions and Codas Type that were found need to be investigated with more detail in the future.

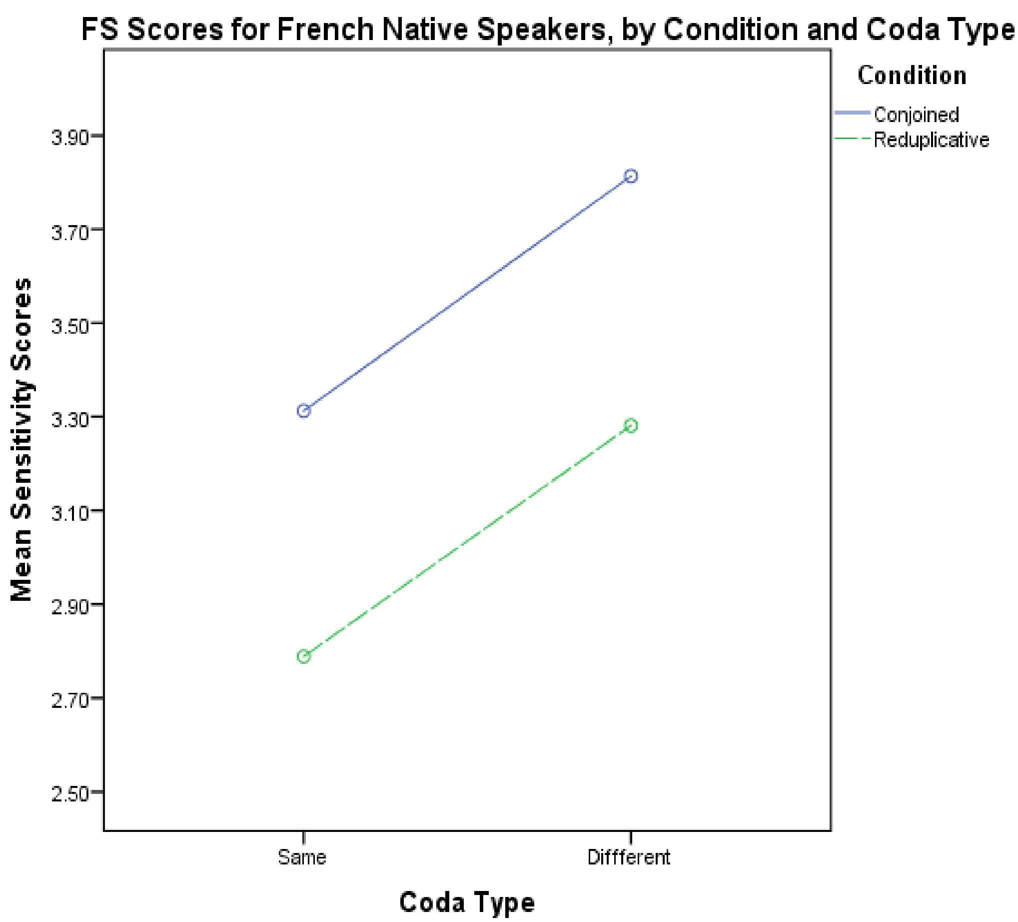

Figure 14. FS Scores for French Native Speakers, by Condition and Coda Type.

Overall, Condition does not have a significant effect on the sensitivity scores, certainly for English speakers, and, with one exception discussed above, for French speakers. Based on this result, I argue that speakers on average are sensitive to DC in both conditions in similar ways. The implication of this finding is that even in conjoined binomials, which are certainly different from reduplicative ones in a number of ways, the same phonological constraints could be applied by speakers. However, these constraints would be less frequently operative in conjoined pairs, because higher-ranked constraints (semantic, frequency) would often collide with them. Despite the fact that conjoined and reduplicative binomials have very different origins, the similarity of their phonological patterns link them together. Southern (2000) made the following observation about the relatedness of reduplicative and conjoined binomials: "...Germanic non-alliterating/rhymeless irreversible binomial formulas represent a substantial related set, whose internal parallelism rests on either symmetry of syllabic structure or language-internal rhythmic euphony of sequence,.." (p. 258). Both reduplicative and conjoined binomials are perceived as playful and expressive verbal formations, and this commonality is reflected in their shared phonological features.

Chapter 5: Correspondence Constraints

5. Results and Discussion

5.1. Results: Experiment 1 (English). With respect to the second part of the test, four juxtapositions were used to gauge the relative strength of putative CC, listed below:

(34). **RHYME:** The output must contain at least one pair of adjacent syllables (feet, stressed syllables) with identical rhymes.

ALLITERATE: The output must contain at least one pair of adjacent syllables (feet, stressed syllables) with identical onsets.

Ident-BR (μ): Correspondent segments have identical moraic content. This constraint militates against moraic discrepancies in corresponding segments in the base and the reduplicant.

***Pl/Lab:** Labial vowels are prohibited.

Four paired-sample t-tests were performed as statistical techniques.

5.1.1. Native English speakers. For native speakers of English, in three out four of these tests statistically significant results were obtained.

First, the comparison between IDENT-BR(μ) and *Pl/Lab showed that ratings for items reflecting these two constraints are statistically different from each other ($t = 2.35$, $p = .032$), with the violation of *Pl/Lab having a much higher mean, in line with the hypothesis. Namely, for the violation of *Pl/Lab the score was 13.35 and for the violation of IDENT-BR(μ) the score was 8.47. These statistics are shown in Table 7 and are graphically represented in Figure 15.

This statistical difference means that native speakers of English prefer the patterns where *Pl/Lab is violated over the violations of IDENT-BR(μ). For example, if participants are faced with the choice of *filky-fealky* vs. *filky-fulky*, they prefer the latter expression, which complies with IDENT-BR(μ), but violates *Pl/Lab. This result corroborates the hypothetical constraint hierarchy proposed by Minkova (2002) for ablaut reduplication: IDENT-BR(μ) >> *Pl/Lab.

A second paired-sample t-test was used to compare the ratings for rhyming and ablaut patterns. The result was found to be statistically significant ($t = 4.48$, $p < .000$). As one can see from Table 8 and Figure 16 given below, rhyming patterns, which represent a violation of ALLITERATE (e.g., *fiply-biply*) had a much higher average rating (14.88) than ablaut patterns (6.71), which violate RHYME (e.g., *fiply-faply*). This means that native English speakers on average have a preference for rhyming patterns over ablaut alliterating patterns, in line with the hypothesis that RHYME may be a high-ranked constraint in English.

Table 7. Native English Speakers: *Pl/Lab vs. IDENT-BR(μ).

Violation	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Violation of *Pl/Lab	13.35	17	4.6	1.11
Violation of IDENT-BR(μ)	8.47	17	5	1.22

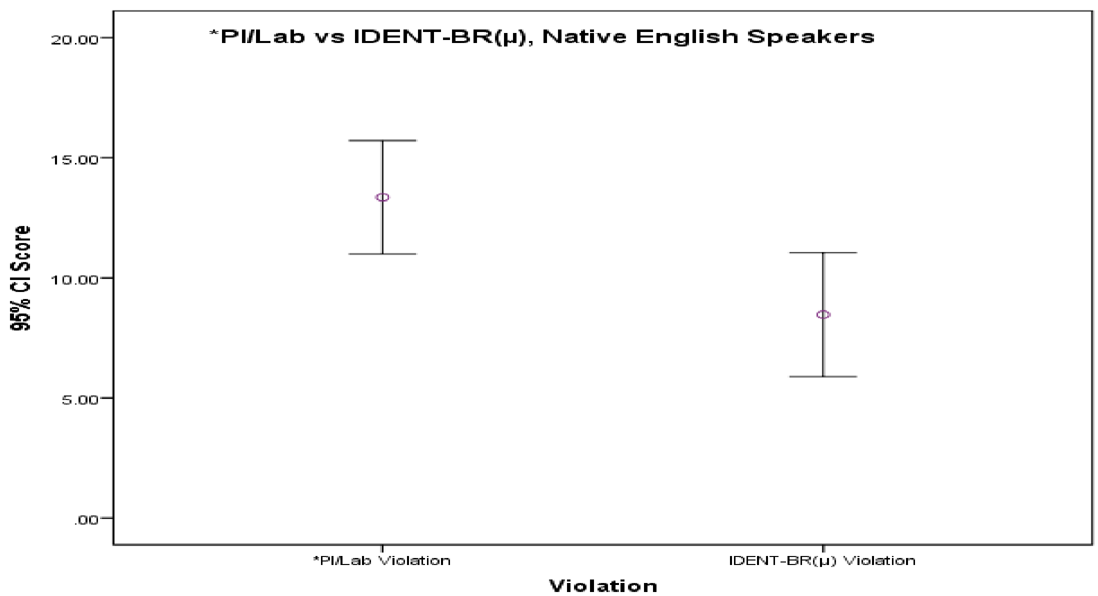

Figure 15. Native English Speakers: *Pl/Lab vs. IDENT-BR(µ)

Table 8. Native English Speakers: Rhyming vs. Ablaut.

Pattern	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Rhyming	14.88	17	4.94	1.2
Ablaut	6.71	17	3.75	.91

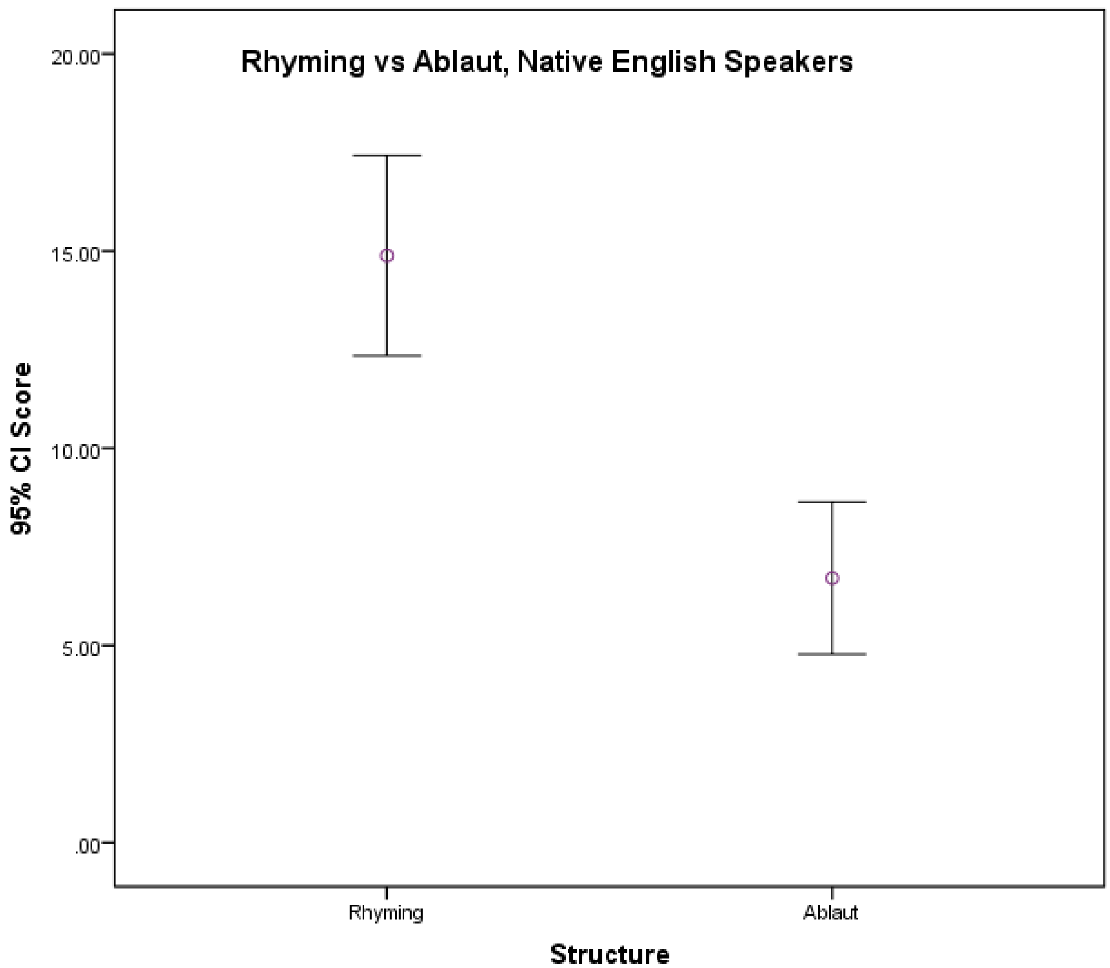

Figure 16. Native English speakers: Rhyming vs. Ablaut.

The objective of the third paired-sample t-test was to juxtapose simple onset rhyming with complex onset rhyming patterns. In order to check which of the two patterns is more acoustically pleasing to the respondents, I used items like *fipret-tipret* vs. *fipret-flipret.* Note that neither item violates RHYME. This comparison reached statistical significance (t = 2.4, p = .029), with items exemplifying simple onset rhyming (e.g., *fipret-tipret)* being preferred over items exemplifying rhyming with complex onset (e.g., *fipret-flipret)*, as illustrated below in Table 9 and Figure 17.

The last paired-sample t-test was performed with the goal of juxtaposing ablaut alliterative patterns with the complex onset rhyming patterns using exemplars like *bipret-bapret* and *bipret-blipret*. Recall that my hypothesis was that the presence of a marked onset will diminish the appeal of a rhyming structure. This t-test did not show statistically significant difference between the two means ($t = .75$, $p = .46$), although the mean for items exemplifying complex onset rhyming is slightly higher than the mean for items exemplifying ablaut alliterative patterns, as we can see from Table 10 and Figure 18.

Summarizing, the juxtaposition of the Correspondence Constraints for native English speakers provided support for the following constraint rankings: IDENT-BR(μ) >> *Pl/Lab; RHYME >> ALLITERATE. However, the latter ranking is weaker if the rhyming pattern contains a complex onset. Thus, on the last t-test, where RHYME and ALLITERATE were pitted against each other, significance was not obtained, possibly because the rhyming pattern had a complex onset. From these results we may conclude that native English speakers on average prefer rhyming patterns with simple onsets. Ablaut received much weaker preference in this group, which might point to the low-ranked status of ALLITERATE.

Table 9. Native English Speakers: Rhyming vs. Complex Onset Rhyming.

Pattern	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Rhyming	13.88	17	6.34	1.54
Complex Onset Rhyming	7.47	17	5.79	1.4

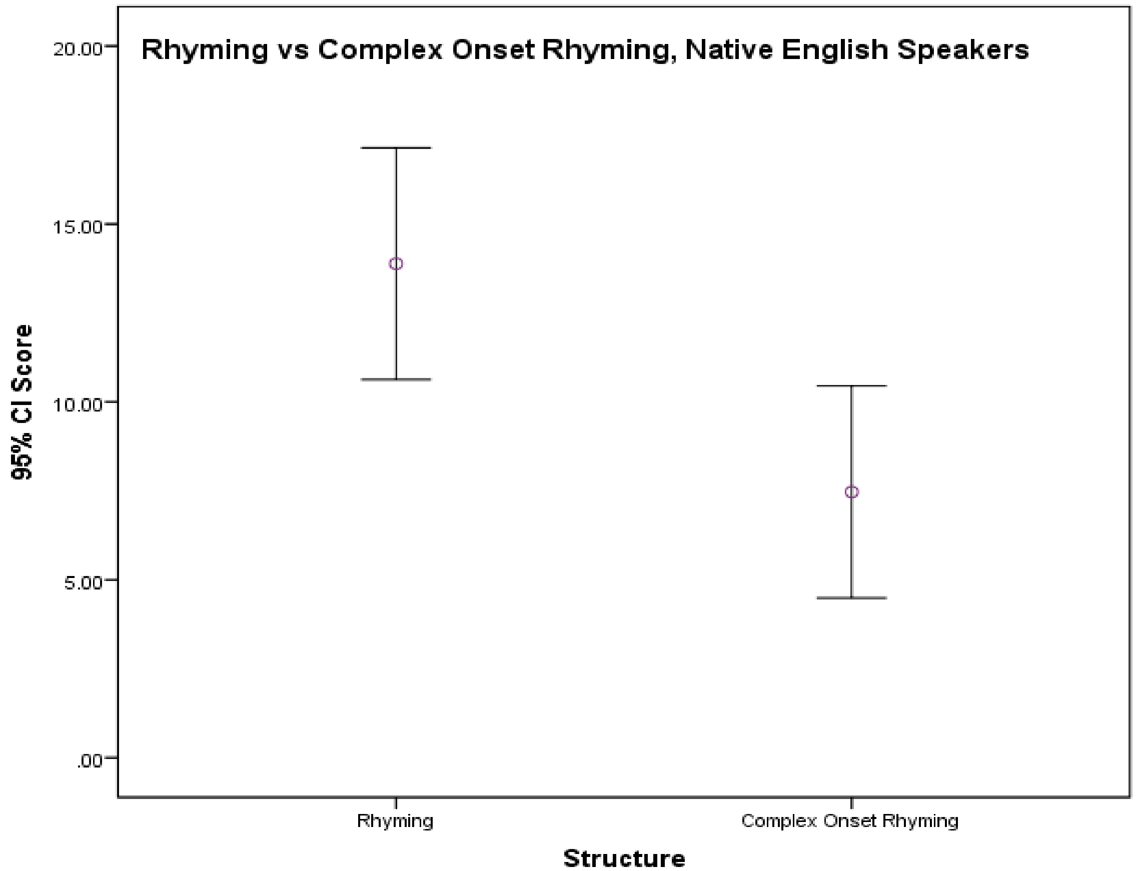

Figure 17. Native English Speakers: Rhyming vs. Complex Onset Rhyming.

Table 10. Native English Speakers: Complex Onset Rhyming vs. Ablaut.

Pattern	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Complex Onset Rhyming	11.41	17	6.33	1.53
Ablaut	9.59	17	4.63	1.12

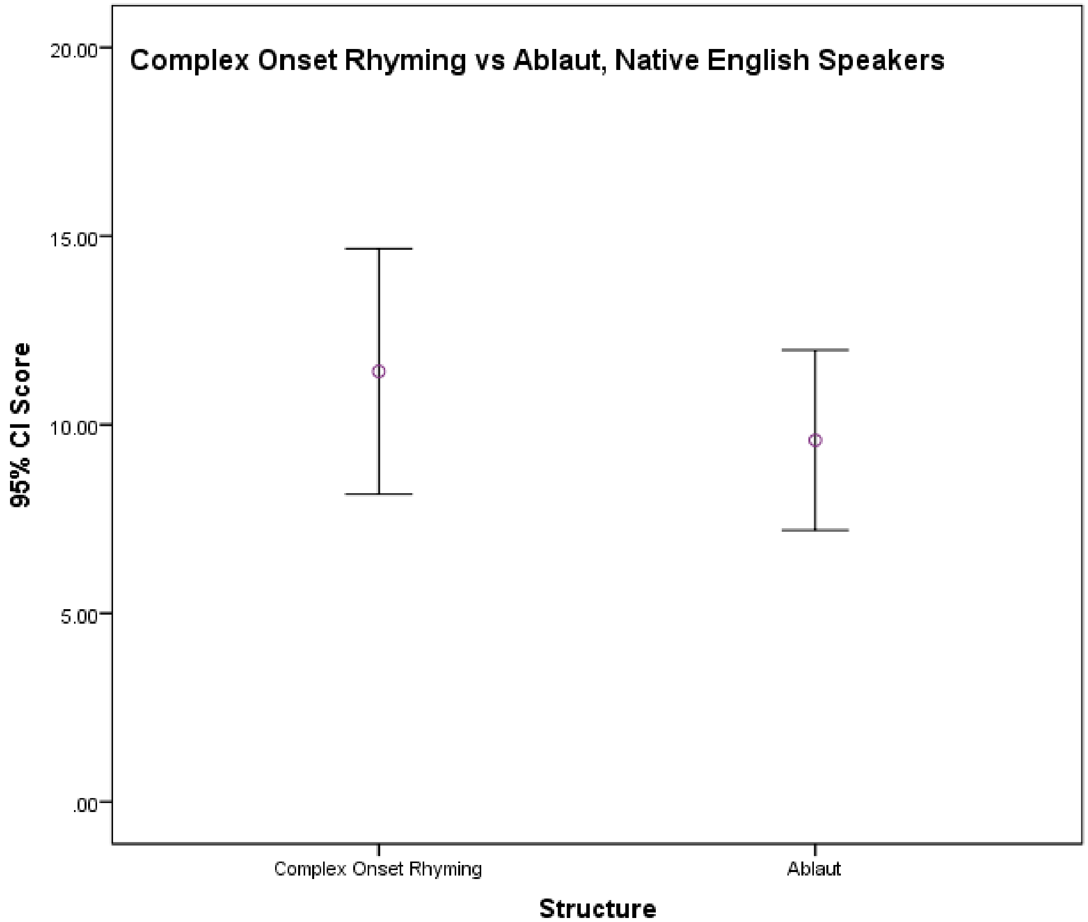

Figure 18. Native English Speakers: Complex Onset Rhyming vs. Ablaut.

5.1.2. Non-native English speakers. The non-native English speakers did not show the same level of sensitivities to the Correspondence Constraints, as out of four t-tests performed, only on the juxtaposition of simple onset rhyming (e.g., *sipoth and tipoth*) and complex onset rhyming (e.g., *sipoth and slipoth*) were statistically significant results obtained ($t = 2.72$, $p = .02$). These results are shown in Figure 19 and Table 11. The statistically significant difference was expected, since complex onsets are marked structures crosslinguistically.

On all the other juxtapositions no statistical differences between the two means were found. On the comparison of the relative strength of IDENT-BR(μ) and *Pl/Lab non-native English speakers tended to prefer *filky-fulky* (violates *Pl/Lab) over the *filky-fealky* (IDENT-BR(μ)), just like native English speakers, but this preference is not significant (t =1.73, p = .10). This is illustrated in Table 12 and Figure 20.

On the comparison of the relative strength of rhyming and ablaut patterns, non-native English speakers, unlike native speakers, tended to prefer ablaut patterns (e.g., *fiply-faply)* over rhyming patterns (e.g., *fiply-biply),* although this preference was not statistically significant for our sample (t = - .5, p = .62). The results of this comparison are shown in Table 13 and Figure 21.

Finally, on the comparison of the relative strength of rhyming with complex onset and ablaut, non-native English speakers, unlike the natives, had a slight preference for ablaut (e.g., *bipret-bapret*) over rhyming with complex onset (e.g., *bipret-blipret),* but this preference is also not significant (t = -.64, p = .53). This is shown in Table 14 and Figure 22.

Table 11. Non-Native English Speakers: Rhyming vs. Complex Onset Rhyming.

Pattern	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Rhyming	14.89	18	7.4	1.7
Complex onset rhyming	6.56	18	6.4	1.5

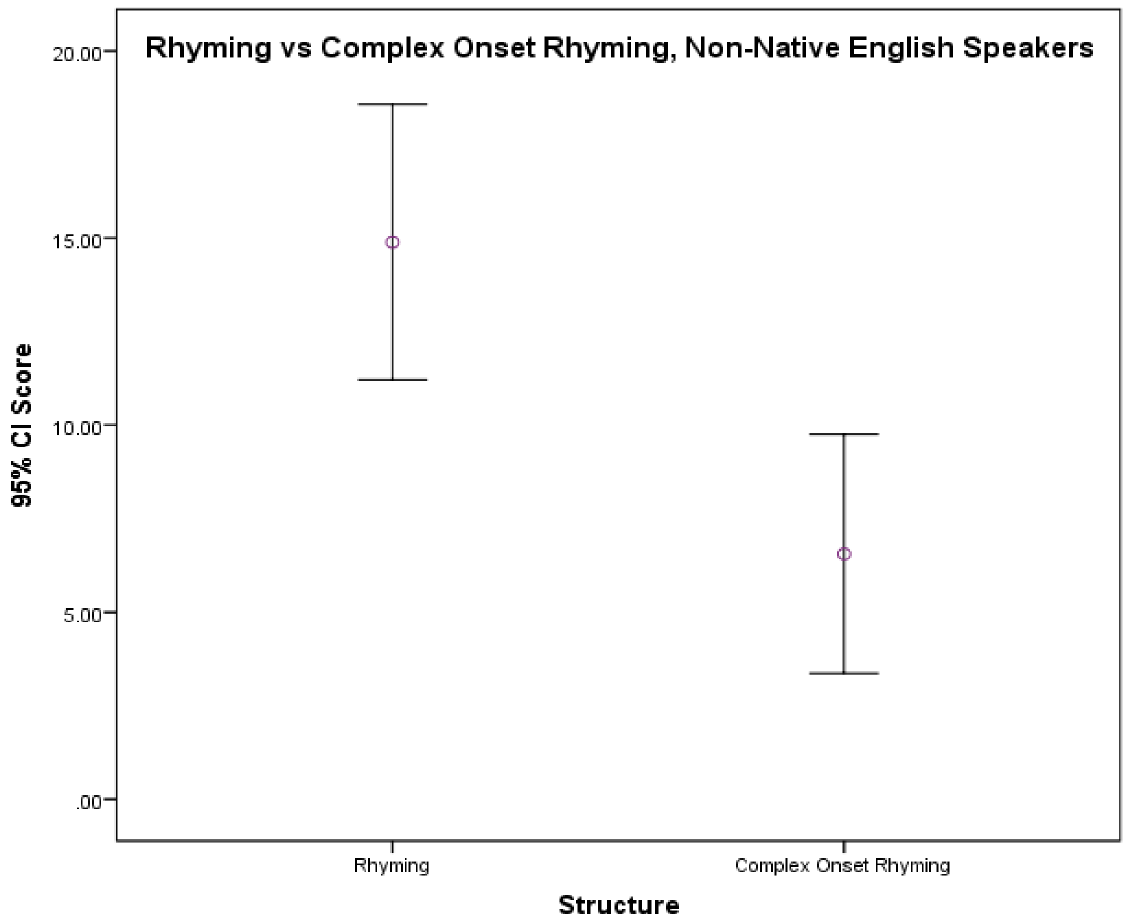

Figure 19. Non-Native English Speakers: Rhyming vs. Complex Onset Rhyming.

Table 12. Non-Native English Speakers: IDENT-BR(μ) vs. *Pl/Lab.

Violation	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Violation of Pl*/Lab	12.7	18	6.2	1.5
Violation of IDENT-BR(μ)	8.4	18	5.2	1.2

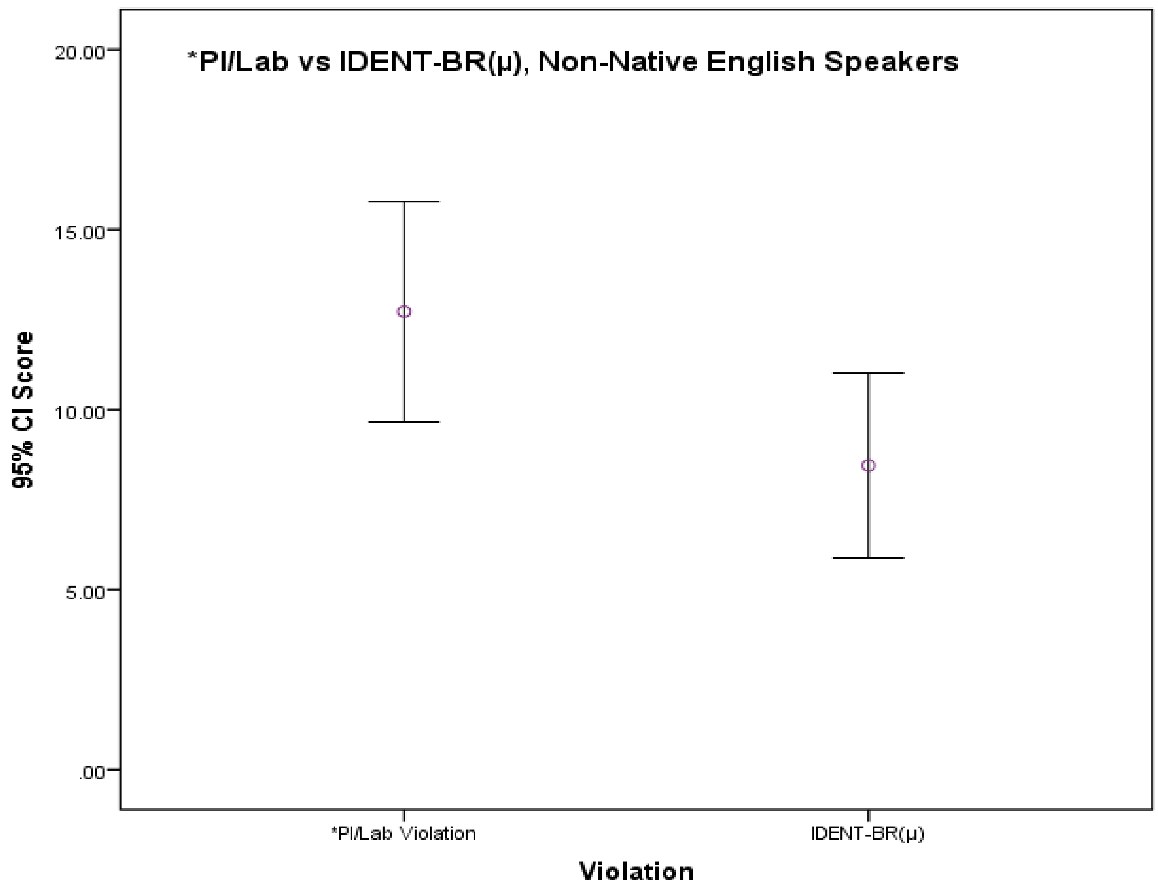

Figure 20. Non-Native English Speakers: IDENT-BR(μ) vs. *Pl/Lab.

Table 13. Non-Native English Speakers: Rhyming vs. Ablaut.

Pattern	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Rhyming	9.8	18	5.4	1.3
Ablaut	11.1	18	6.2	1.5

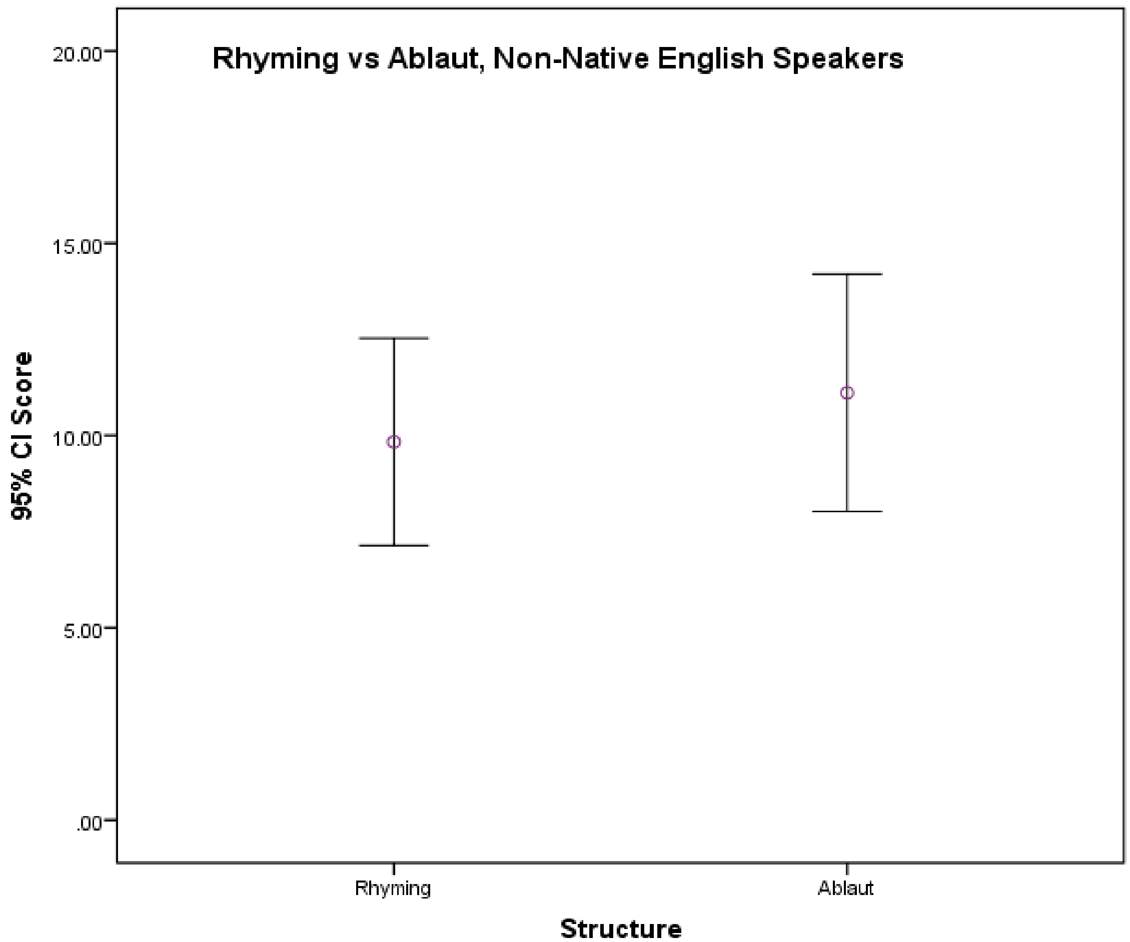

Figure 21. Non-Native English Speakers: Rhyming vs. Ablaut.

Table 14. Non-Native English Speakers: Complex Onset Rhyming vs. Ablaut.

Pattern	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Complex onset Rhyming	10	18	5.2	1.2
Ablaut	11.7	18	7	1.7

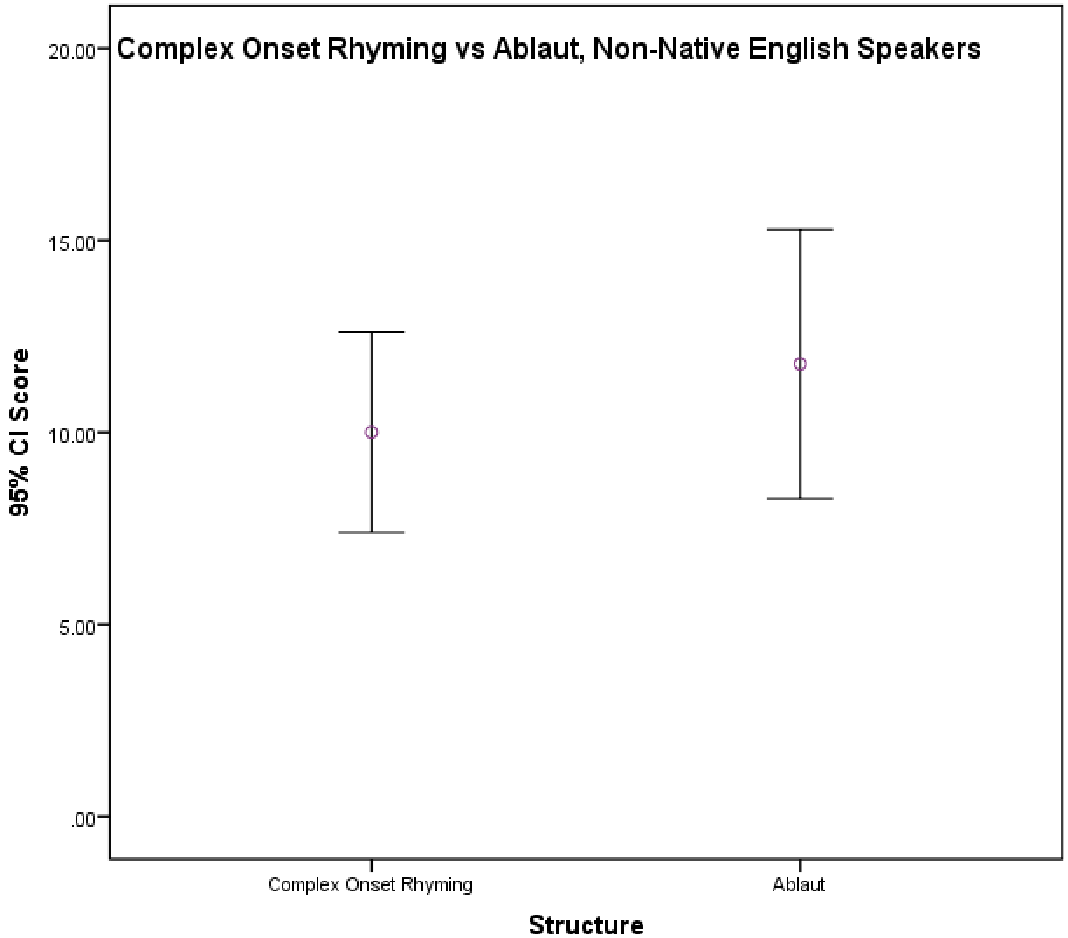

Figure 22. Non-Native English Speakers: Complex Onset Rhyming vs. Ablaut.

Overall, non-native speakers of English did not exhibit the same sensitivities as native speakers. One very obvious difference between the two groups is that native speakers of English preferred rhyming patterns over ablaut alliterating patterns, while non-native speakers did not exhibit the same level of strong preference.

5.2. Results: Experiment 2 (French). The same four t-tests were conducted in the French experiment.

5.2.1. Native French speakers. The first paired-sample t-test for native French speakers revealed a statistically significant difference between the mean ratings for items exemplifying *Pl/Lab and IDENT-BR(μ) ($t=3.6$, $p = .003$). This is shown in Table 15 and Figure 23. Similarly to the other groups of participants, French native speakers exhibited a much higher mean rating for the violation of *Pl/Lab (e.g., *glavette-glavotte*) than for the violation of IDENT-BR(μ) (e.g., *glavette-glavinte*). Thus, although Minkova (2002) formulated these constraints for English ablaut reduplication, French speakers' intuitions seem to also be in line with the proposed constraint hierarchy: IDENT-BR(μ) >> *Pl/Lab.

A second t-test was performed with the purpose of comparing the means for ablaut and rhyming patterns. This t-test also showed a significant difference between two scores ($t = -2.3$, $p = .03$). However, unlike native English speakers, French speakers had a stronger preference for the ablaut patterns (e.g., *saubette-saubotte*) than for the rhyming patterns (e.g., *saubette-daubette*). This is shown in Table 16 and Figure 24.

The third t-test showed a statistically significant difference between the means for the simple rhyming pattern and complex onset rhyming pattern ($t= 7.7$, $p = .000$). For example, items like *sagli-tagli* received much higher scores than items like *sagli-stagli*. This is illustrated in Table 17 and Figure 25.

The last t-test for this group revealed a statistically significant difference between the mean ratings for items exemplifying complex onset rhyming and ablaut ($t = - 4.8$, $p = .000$), however, unlike native English speakers, native French speakers chose more often the ablaut patterns than complex onset rhyming. This is illustrated in Table 18 and Figure 26.

Table 15. Native French Speakers: *Pl/Lab vs. IDENT-BR(μ).

Violation	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Violation of *Pl/Lab	16.1	16	6.8	1.7
Violation of IDENT-BR(μ)	5.9	16	5.6	1.4

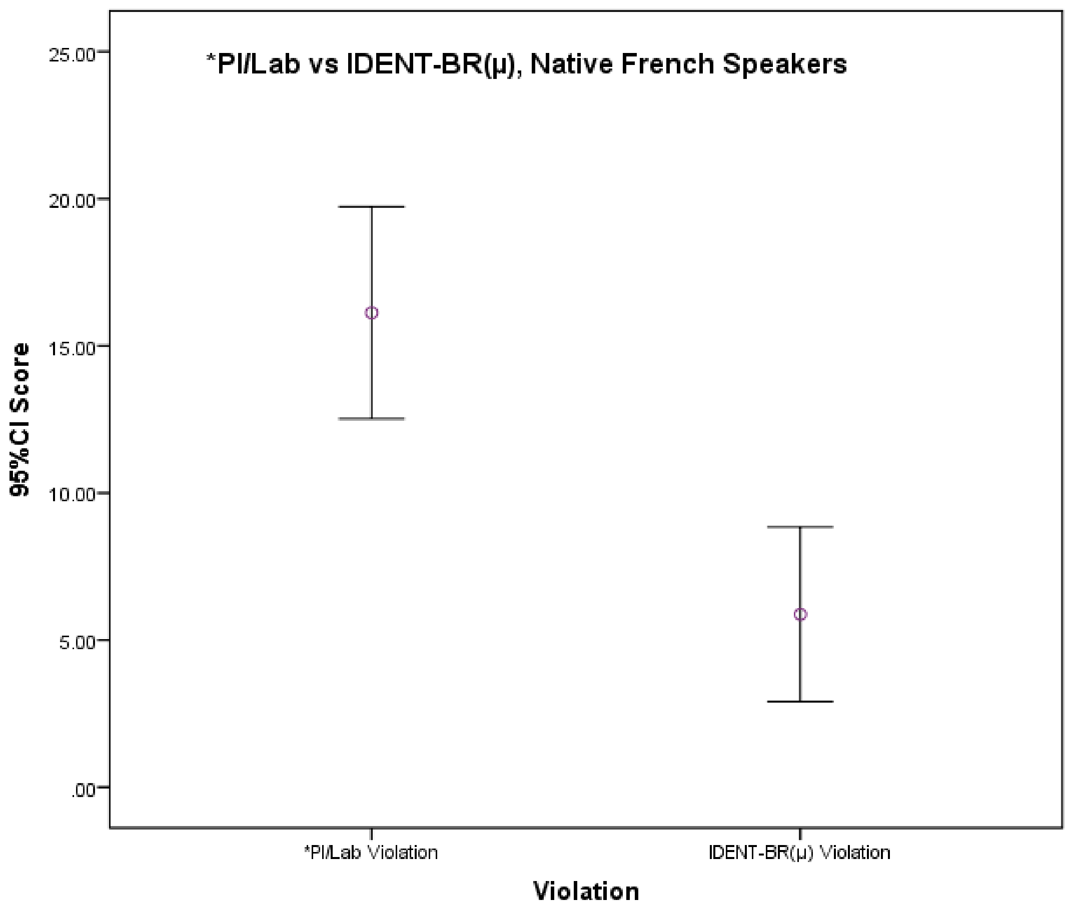

Figure 23. Native French Speakers: *Pl/Lab vs. IDENT-BR(μ).

Table 16. Native French Speakers: Rhyming vs. Ablaut.

Pattern	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Rhyming	8.1	16	4.4	1.1
Ablaut	14	16	6.5	1.6

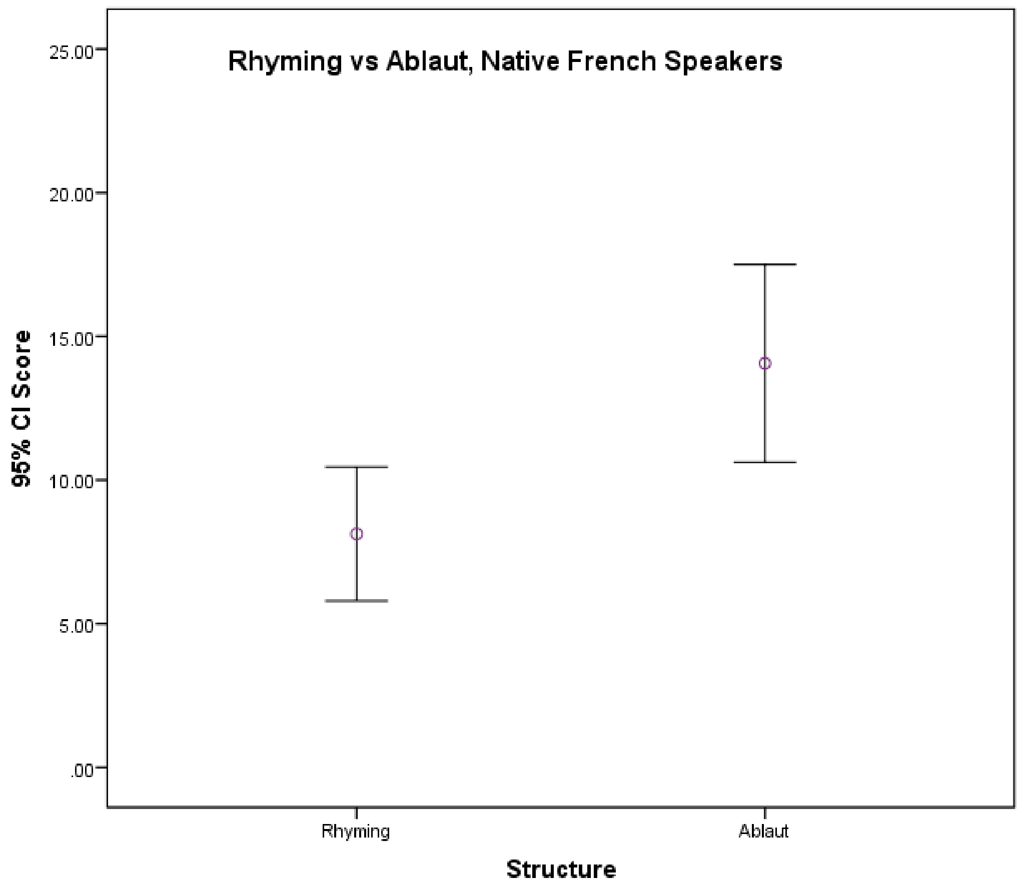

Figure 24. Native French Speakers: Rhyming vs. Ablaut.

Table 17. Native French Speakers: Rhyming vs. Complex Onset Rhyming.

Pattern	Mean	N	Std. Deviation	Std. Error Mean
Rhyming	17.9	16	4.7	1.2
Complex onset rhyming	4	16	3	0.7

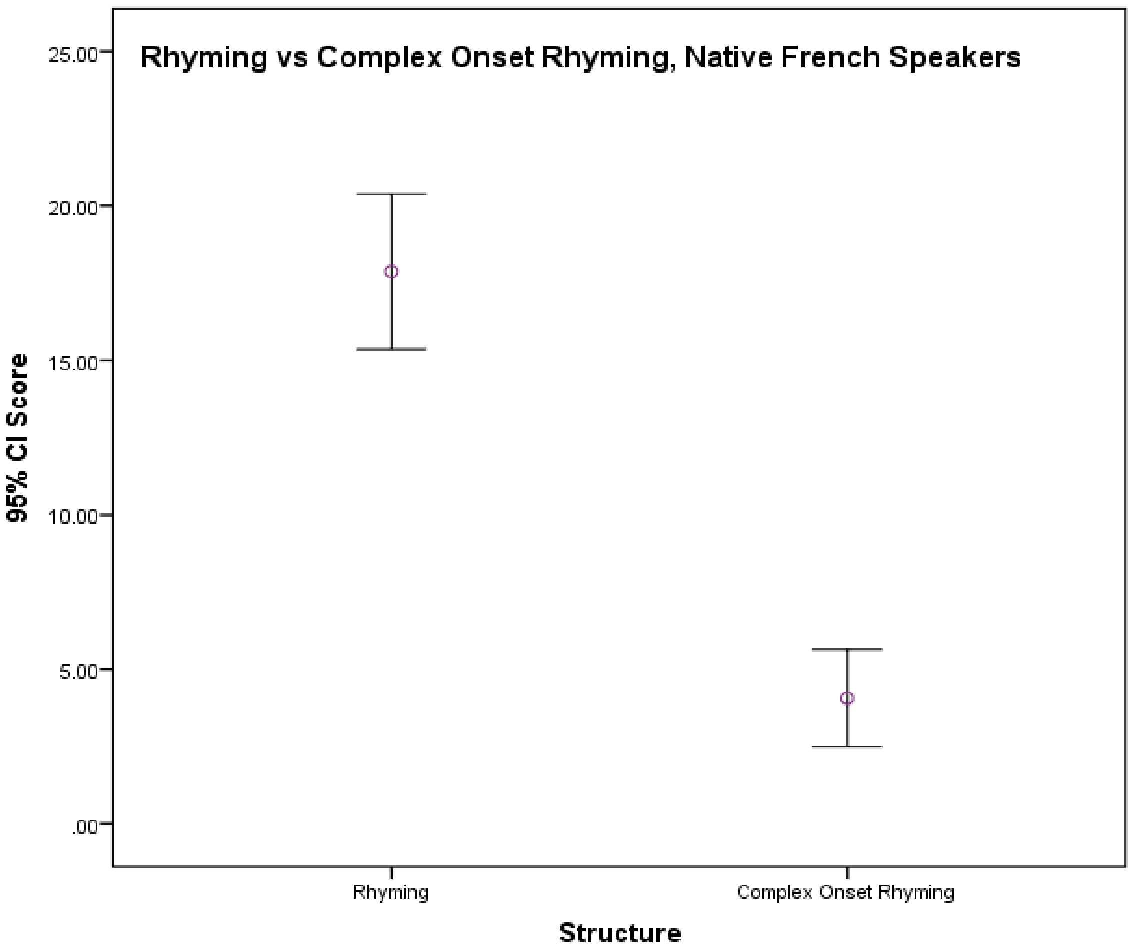

Figure 25. Native French Speakers: Rhyming vs. Complex Onset Rhyming.

Table 18. Native French Speakers: Complex Onset Rhyming vs. Ablaut.

Pattern	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Complex onset rhyming	5.1	16	4.5	1.1
Ablaut	17.6	16	6.6	1.7

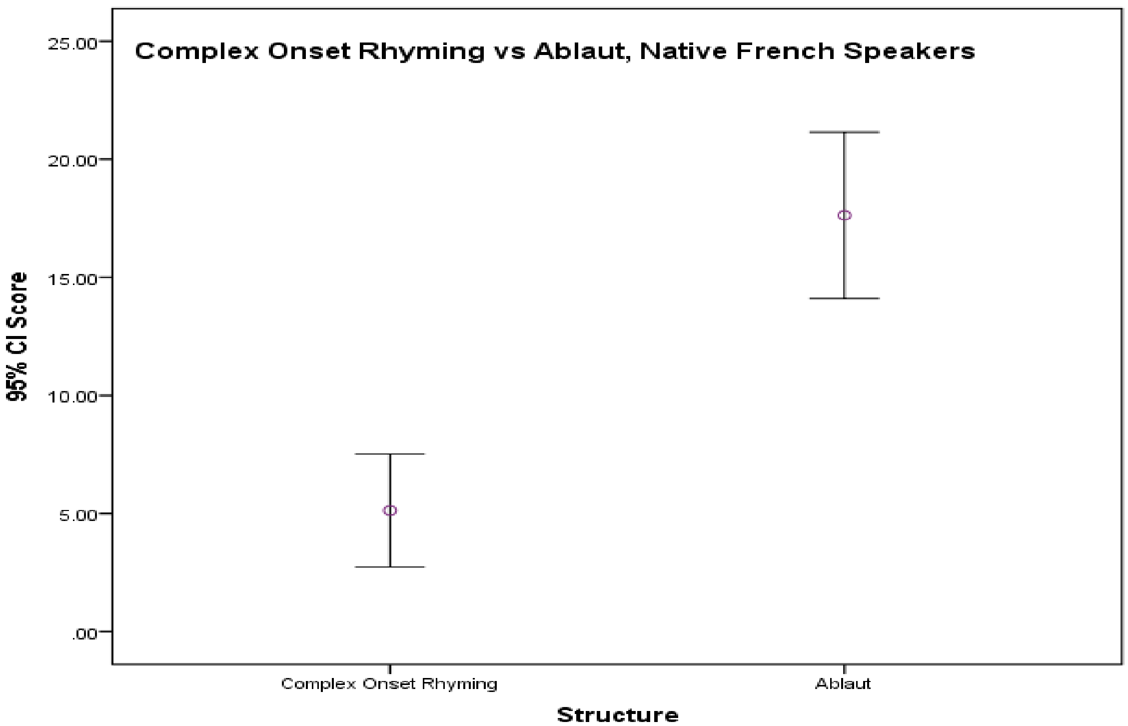

Figure 26. Native French Speakers: Complex Onset Rhyming vs. Ablaut.

Overall, the following Correspondence constraint hierarchy emerged from the four t-tests performed on the French native speakers' data: IDENT-BR(μ) >> Pl*/Lab; ALLITERATE >> RHYME. Another notable finding is that rhyming with complex onsets received much lower scores for French speakers than for English speakers.

5.2.2. Non-native French speakers. All the four paired-sample t-tests for non-native French speakers were statistically significant, and their performance was very similar to the performance of the French native speakers.

The first paired-sample t-test for non-native French speakers revealed a statistically significant difference between the means of *Pl/Lab and IDENT-BR(µ) (t= 3.5, p = .003). French non-native speakers had a much higher mean for the violation of *Pl/Lab than for the violation of IDENT-BR(µ), which is a result that is consistent with the hypothesis IDENT-BR(µ) >> *Pl/Lab, and with the results of both French and English native speakers. This is illustrated in Table 19 and Figure 27.

The second paired-sample t-test was performed to compare ablaut and rhyming patterns. This t-test resulted in a significant difference between the two means (t = - 6.4, p = .000), and ablaut patterns (e.g., *saubette-saubotte*) received a much higher score than rhyming patterns (e.g., *saubette-daubette*). This is consistent with the pattern that was seen for French natives. Table 20 and Figure 28 illustrate this finding.

The third t-test showed a statistically significant difference between the mean rating for the rhyming pattern and the mean rating for the complex onset rhyming (t= 3.8, p = .002). Similarly to native French speakers, this group preferred the rhyming patterns (e.g., *sagli-tagli*) over the complex onset rhyming (e.g., *sagli-stagli*). This is shown in Table 21 and Figure 29.

The final t-test for this group also resulted in a statistically significant difference between the mean for the complex onset rhyming pattern and the ablaut pattern (t = - 5.9, p = .000). Non-native French speakers had a similar performance to the native French speakers and chose more often the ablaut pattern (e.g., *sagli*-*sagla*) than the complex onset rhyming pattern (e.g., *sagli*-*stagli*). This is illustrated in Table 22 and Figure 30.

Overall, this group exhibited compliance with the same constraint hierarchy as native French speakers: IDENT-BR(μ) >> *Pl/Lab; and ALLITERATE >> RHYME.

Table 19. Non-Native French Speakers: IDENT-BR(μ) vs. *Pl/Lab.

Violation	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Violation of *Pl/Lab	12.88	16	4.3	1.1
Violation of IDENT-BR(μ)	5.69	16	4.7	1.2

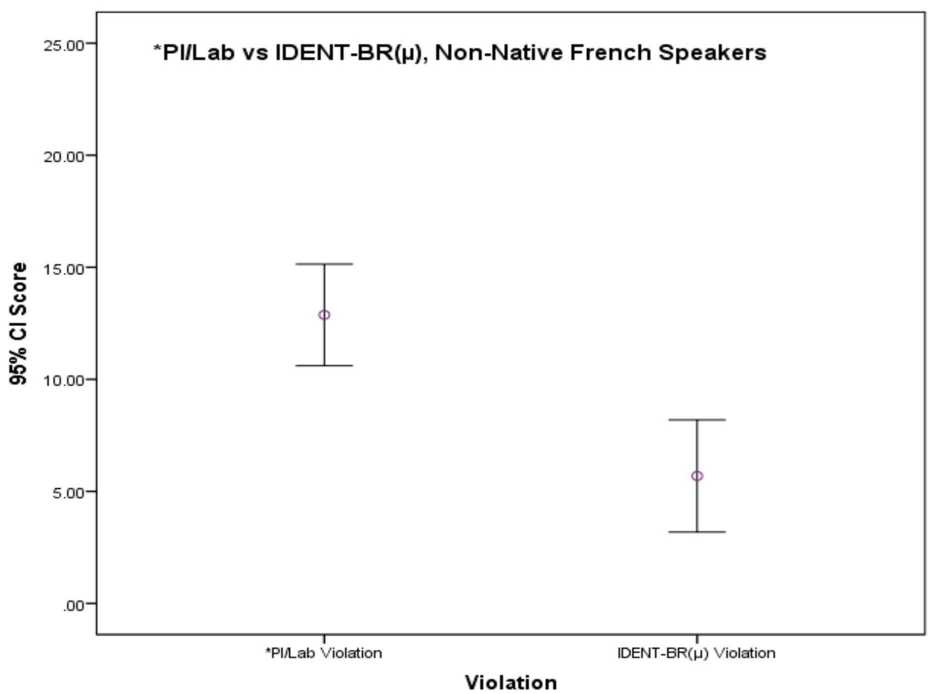

Figure 27. Non-Native French Speakers: IDENT-BR(μ) vs. *Pl/Lab.

Table 20. Non-Native French Speakers: Rhyming vs. Ablaut.

Pattern	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Rhyming	4.3	16	2.8	0.7
Ablaut	16.3	16	5.1	1.3

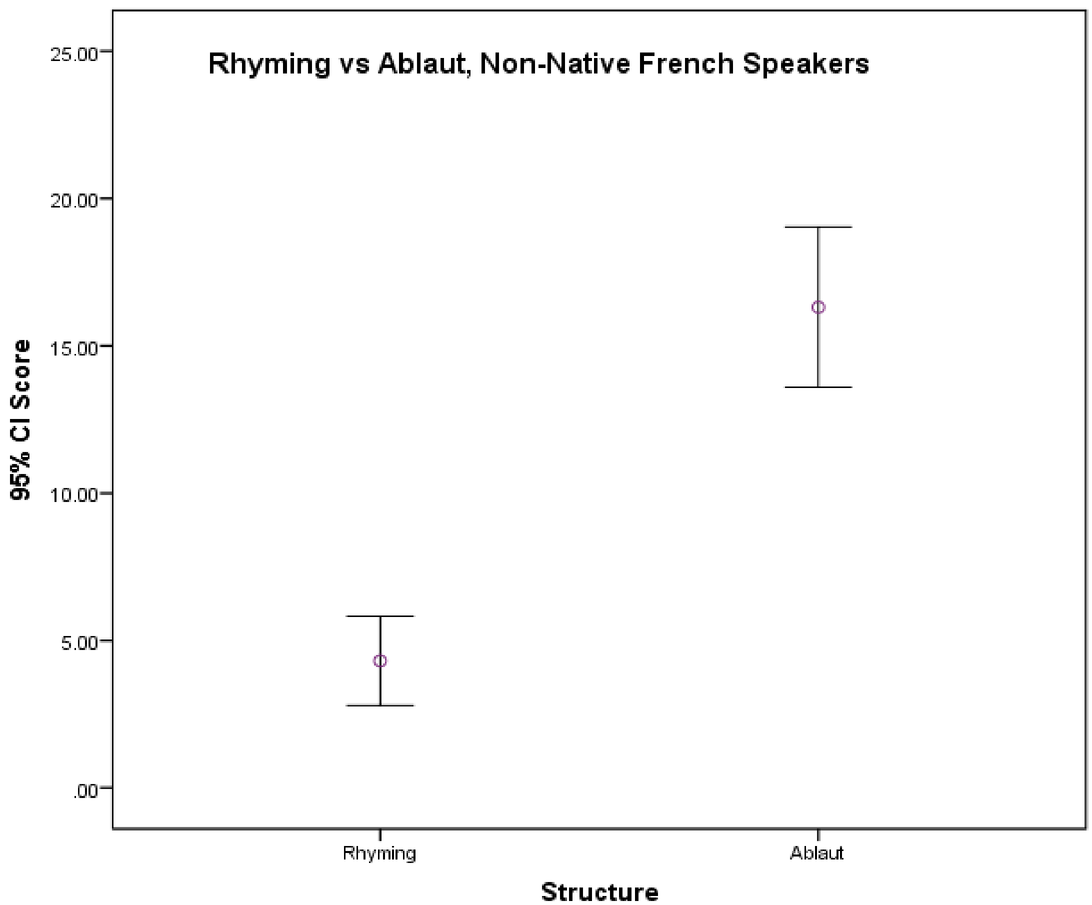

Figure 28. Non-Native French Speakers: Rhyming vs. Ablaut.

Table 21. Non-Native French Speakers: Rhyming vs. Complex Onset Rhyming.

Pattern	Mean	N	Std. Deviation	Std. Error Mean
Rhyme	14.3	16	5.5	1.4
Complex onset rhyming	5.3	16	4.4	1.1

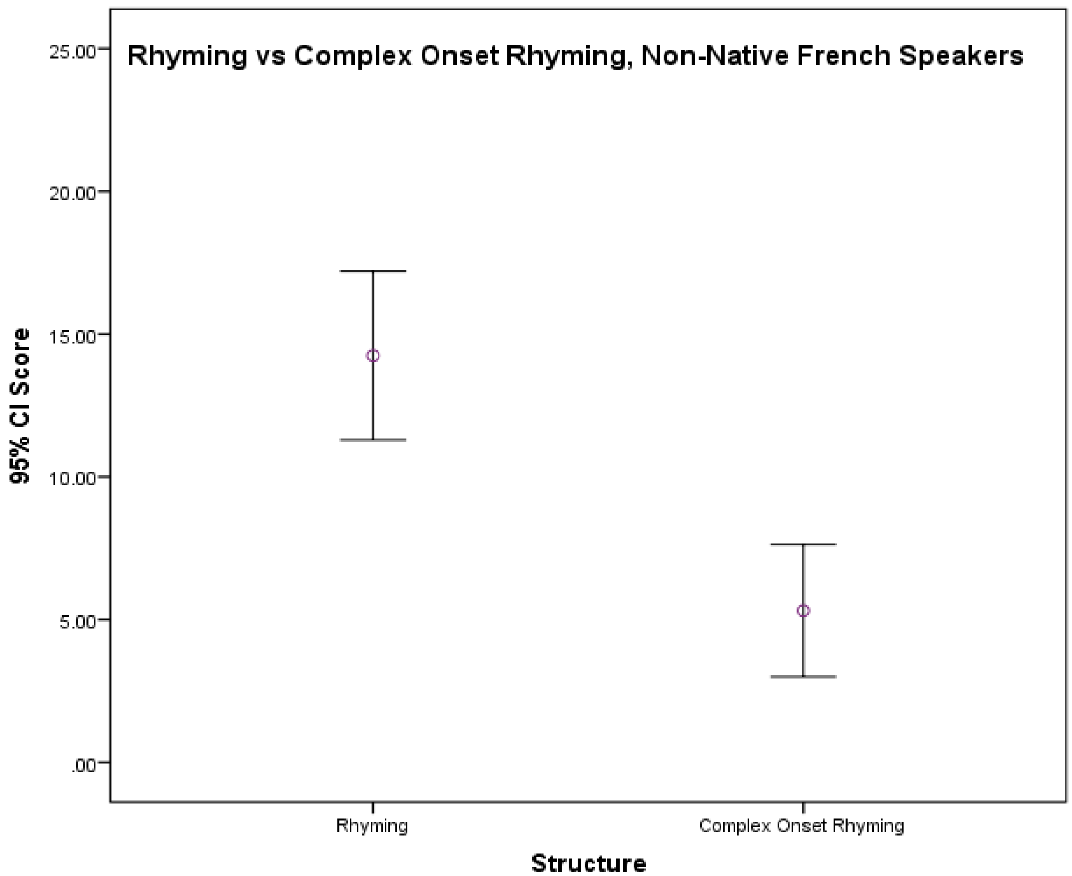

Figure 29. Non-Native French Speakers: Rhyming vs. Complex Onset Rhyming.

Table 22. Non-Native French Speakers: Complex Onset Rhyming vs. Ablaut.

Pattern	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Complex onset rhyming	4	16	3.6	0.9
Ablaut	16.9	16	5.9	1.5

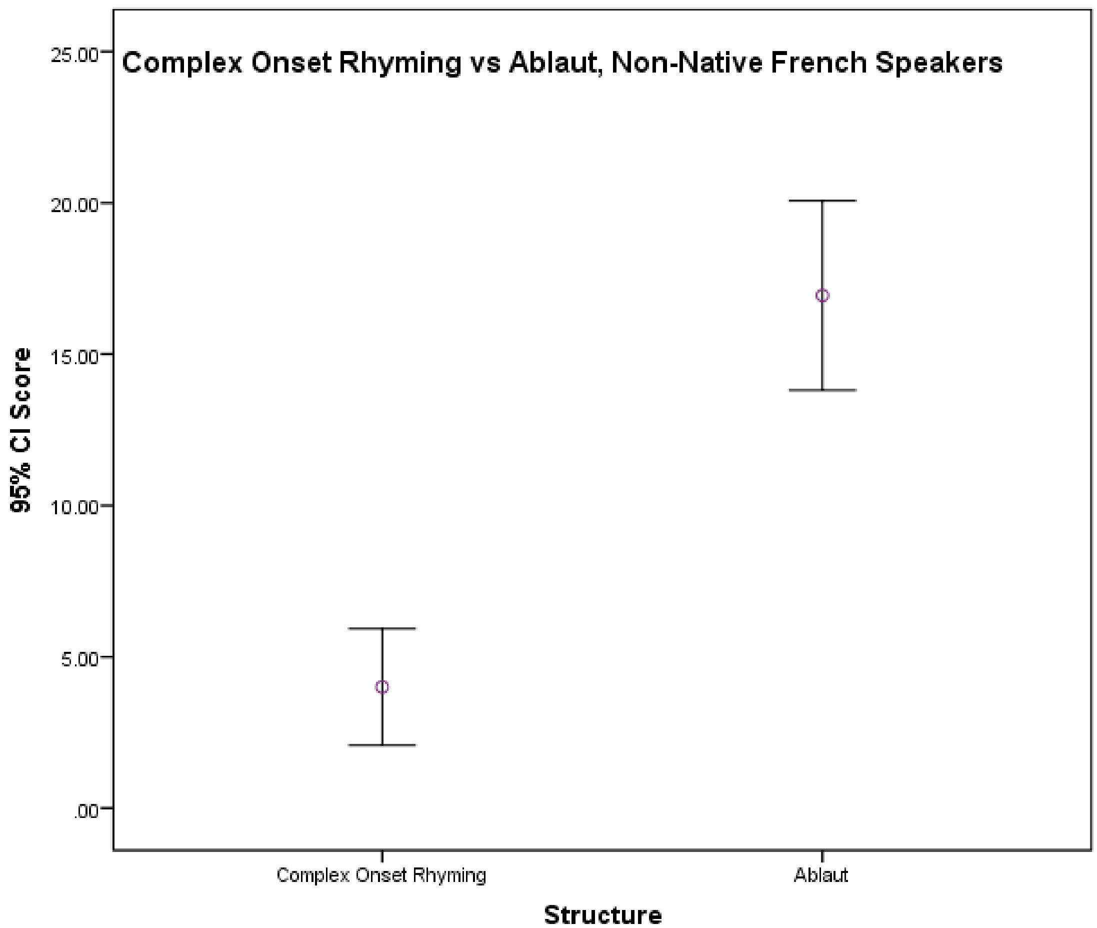

Figure 30. Non-Native French Speakers: Complex Onset Rhyming vs. Ablaut.

5.3. Discussion.

5.3.1. IDENT-BR(μ) vs. *Pl/Lab. For this juxtaposition the results were significant for 3 out of 4 groups of participants – native speakers of English and French and learners of French. Even for the group of non-native English speakers, whose results did not reach significance, the difference between the two means still shows the expected pattern: IDENT-BR(μ) >> *Pl/Lab.

Although this part of the study does not appeal to an OT account, constraints identified in the OT literature were used here to test speakers' intuitions for more felicitous sound templates. The two options that were given to the participants were not the ideal options, since both of them violated the high-ranked constraints, proposed in Minkova's 2002 study; however, the statistically significant difference between the two means points to the fact that one of the violations is much more acceptable in speakers' grammars than the other. This part of the study echoes my observation from the previous chapter, namely that speakers tend to prefer maximal changes in the <u>quality</u> of the nuclei (height or advancement) over categorical changes in <u>duration</u>, even if the change in quality results in a marked structure, such as a labial vowel in *filky-fulky*.

The preference for maximal changes in vowel quality may be grounded in the need of being more "expressive". Indeed, *filky-fulky* sounds impressionistically more expressive than the flat and monotonous *filky-fealky*. The studies of expressive values of vowels examine the corner vowels (i,a,u), or the mid-vowels (e,o), that is, vowels that are opposed to each other on either F1 or F2 dimensions. This study has already talked about the iconic values of vowels in the previous chapter, and the phonosemantic associations of *i* with lightness and *a* with heaviness. These kinds of claims have also been made in the French linguistics literature. For example, Plénat (1999), argued that French uses evaluative suffixes to convey various expressive meanings. He gives an example of three French verbs, all three with the same basic meaning of "dance", but each having a separate expressive value transmitted by the vocalic suffix: *dans**i**ller, dans**ou**iller, dans**a**iller*. According to Plénat, /i/ in *dansiller* has the value of affectionate commiseration, /u/ in *dansouiller* has the value of a friendly irony, but the value of /a/ in *dansailler* is a very negative one, tied to the meaning of hatred or contempt: "La répartition de ces variantes est tributaire principalement du contexte phonique, mais, quand le contexte laisse un choix, il semble que chaque type de voyelle soit liée à une nuance du sentiment de supériorité : supériorité teintée de commisération affectueuse pour les voyelles hautes, d'ironie bonhomme pour les voyelles rondes et de haine ou de mépris pour les voyelles basses" (p. 204). "The distribution of these variants depends mainly of the phonic context, but when the context leaves a choice, it seems that each type of vowel is linked to a nuance of the feeling of superiority: superiority tinted with affectionate commiseration for high vowels, good-natured irony for rounded vowels and hatred or contempt for low vowels"[8]. The expressive vocalic values can vary, depending on language and context; for example, /a/ could be associated with disdain, not only with heaviness or large size. However, regardless of what expressive values they carry, it is

[8] My translation.

the vowels that are opposed to each other in quality that seem to carry expressive values. To my knowledge, vowels that are each other's opposites in terms of phonological length (e.g., /i/ and /I/) or nasality (e.g., /ɛ/ and /ɛ̃/), have not been identified as having expressive values of any kind. Perhaps, this is because their contrastiveness seems too flat, too uninteresting, and too plain to be expressive.

***5.3.2. Rhyming vs. Ablaut*.** For this juxtaposition, the performance across the groups was not homogenous. Native English speakers had a strong preference for rhyming patterns in their language. Non-native English speakers did not have a strong preference, while both native and non-native French speakers preferred ablaut alliterating pattern.

Since many of naturally occurring binomials rhyme, my hypothesis was that RHYME would be the strongest constraint, irrespective of the language. This would mean that speakers of both languages and their learners would generally prefer the modifications inside the onsets, keeping the phonological rhymes identical. However, this was not the case, because only native speakers of English exhibited this particular pattern. At least one plausible explanation of the difference between English and French speakers may be related to the differences in metrical structures of the two languages. From the inception of this study, a decision was made to keep all the experimental items disyllabic, for both languages. This decision led to a few differences in stress patterns between some of the English and French experimental items. As a reminder, for English exemplars, the stress was always assigned to the syllable in which there was a contrast, so that the contrasting sounds would be in a salient position. But for French it was not always possible to align the contrasting segments with the stressed syllables. This was one of such cases: in French, stressing the first syllable of a disyllabic word is impossible, and therefore, all the nonsense items were stressed on the second syllable (e.g., *saub**ette**-daub**ette***). Thus, in *saub**ette**-daub**ette*** the stressed syllable **did not** contain the contrastive segments /s/ and /d/, while in *saub**ette**-saub**otte*** the stressed syllable contained the contrastive segments /ɛ/ and /ɔ/. Accordingly, one of the reasons why French speakers may have consistently chosen the ablaut pattern is because in the rhyming pattern the contrast was not salient enough, since it was always in a weak position. If this is indeed the case, we can't be sure that French speakers generally prefer ablaut patterns over rhyming patterns; we can only say that they have this preference in disyllabic words. In the future research, in order to see if the results of the present study could be replicated, French preferences should be retested with monosyllabic words. If French speakers exhibit the same preferences on monosyllabic than on multisyllabic words, then there would be more satisfactory evidence that French prefer ablaut alliteration over rhyming as a general trend.

Another potential issue with the French items is the directionality. When the test was designed, because of the lack of previous research on the directionality preferences in French, most of the hypotheses for French were formulated in the same way as for English. This led to the creation of items like *sagli-tagli,* where the directionality follows the English pattern, a more sonorant consonant in the first position. However, in the first block of this experiment French speakers preferred the opposite directionality, a more obstruent onset in the first position, and this result reached significance. This was not known or anticipated when the experiment was designed. Because the directionality for French rhyming items ended up being the opposite of their preference, speakers may have chosen *sagli-sagla* more often than *sagli-tagli*, simply because *sagli-tagli* violates the directionality in French, while *sagli-sagla* does not. Again, in the future studies these limitations have to be addressed and the design concerns have to be taken into account.

In English, because both contrasts, a contrast between vowels (e.g., *fiply-faply*) and a contrast between initial consonants (e.g., *fiply-biply*) were found in the first stressed syllable, both contrasts were, potentially, equally salient. Thus, the fact that English speakers consistently chose rhyming pattern cannot be a by-product of the design. Rather, in this fact, I see the confirmation of the hypothesized difference between RHYME and ALLITERATE: RHYME>>ALLITERATE. Ablaut alliterative reduplication, as pointed out by Minkova (2002), is no longer a very productive phenomenon in English; this may be the reason why English speakers prefer it less than rhyming patterns, which are more productive.

5.3.3. Rhyming vs. complex onset rhyming. The four groups of participants exhibited similar intuitions on this juxtaposition. Specifically, all participants, regardless of their group affiliation, more often preferred simple onset rhyming patterns (e.g., *fiply-biply, sagli-tagli*) over complex onset rhyming (e.g., *fiply-fliply, sagli-stagli*). Although complex onsets are allowed in both English and French, when faced with the choice of complex vs. simple onset, most participants would prefer a simple onset. This result is not particularly surprising, because complex onsets are crosslinguistically marked. However, a more careful look at the means reveals that French speakers exhibited stronger dispreference of complex onsets than English speakers. The difference between the means for simple onset rhyming and complex onset rhyming was much larger for French native speakers (13.9) than for English native speakers (7.41). From the theoretical standpoint, it seems appropriate to evoke here the division of languages into stressed-timed and syllable-timed. French represents the latter type, and as such, it is less likely to allow complex consonantal clusters. Indeed, one of the main distinctive features of syllable-timed languages is: they "devote a similar amount of time to pronouncing each syllable in an utterance" (Lahoz, 2012, p. 131). A syllable consisting of a consonant cluster would take more time to say than a simpler CV syllable, with the consequence that consonantal clusters would be highly marked. English, as a stress-timed language, tends to maintain <u>stressed</u> syllables at relatively equal intervals, and be more tolerant of complex consonantal clusters. Therefore, the differences in acceptance of consonantal clusters between French and English subjects may be a reflection of the differences between the metrical systems of their languages. Interestingly, and not very surprisingly, French L2 learners, who were all native speakers of English, had the difference between the means for complex and simple onset rhyming equal to 9, which is not quite as large as for French native speakers, and not as small as for English native speakers.

5.3.4. Complex onset rhyming vs. ablaut. Native speakers of French and L2 learners of French performed in a similar fashion on this last juxtaposition; both groups preferred ablaut. The result is not surprising, and seems even more logical in light of the previous discussion of the metrical systems of French and English. Indeed, an ablaut alliterative pattern (e.g., *sagli-sagla*) seems to be a much better choice than a rhyming pattern with a complex onset (e.g., *sagli-stagli*) for two reasons: first, the contrastive segments coincide with the salient position in *sagli-sagla,* and second, *sagli-sagla* does not contain consonantal clusters.

For English speakers, both learners and natives, the result for this juxtaposition was not statistically significant. Native English speakers tended to prefer rhyming patterns with complex onsets (e.g., *fiply-fliply*) slightly more than ablaut (e.g., *fiply-faply*), while the L2 learners had the opposite pattern of preference. Although these patterns are not robust, they are nevertheless informative in the sense that they align with the hypothesis that English native speakers tend to prefer rhyme.

Chapter 6: Native Speakers and L2 Learners

6. Performance Differences between Two Groups of Learners

For Directionality Constraints, L2 learners of both languages performed similarly to native speakers. For Correspondence Constraints, learners of French showed a more native-like performance than learners of English. This may mean that by the time learners achieve advanced levels of proficiency, their intuitions with regard to what expressive phonological patterns are more felicitous in their L2 might be quite comparable to those of native speakers, at least for DC. Note that in Birdsong (1979) study the proficiency level also seemed to be important for the native-like results on the DC task: in his study, intermediate learners were closer to the native speakers' intuitions than beginners. In what follows I discuss the differences in performance between the two groups of learners in the present study (L2 learners of English and L2 learners of French), mainly on Correspondence Constraints.

6.1. English and French metrical systems. L2 learners of French and French native speakers had very similar patterns on all four juxtapositions for CC, while L2 learners of English and English native speakers exhibited similar preferences or absence of preferences only for two juxtapositions out of four. For instance, learners of English did not show the same strong preference for rhyming over ablaut alliterative patterns than native speakers, and furthermore, they did not have a solid preference when choosing between the violations of *Pl/Lab and IDENT-BR(μ). This observation brings up the question of whether there is a reason why L2 learners of French performed in a more similar fashion to native speakers than L2 learners of English.

There might be at least two reasons why this happened. First of all, learners of English were a more heterogeneous group: inside this group there were representatives of a variety of languages, including German, Spanish, Cantonese, Czech, etc. Native language undoubtedly impacts one's linguistic intuitions, hence, it is very plausible that learners of English as a group had a lot more variation in their responses simply because they all come from very different linguistic and cultural backgrounds.

Another plausible explanation for the relative native-likeness of L2 learners of French on this task may be linked to the hypothesis that French metrical system may be easier to acquire than the metrical system of a language like English, with the lexical stress and larger differences in syllabic weight and length.

There is some support for this claim that comes from the crosslinguistic studies on child language development. Grabe, Post, & Watson (1999) examined rythmical patterns of four years old French and English children and their mothers. They focused on measuring the length of vowels in utterances of minimally four syllables (IP-final syllables were excluded from the measurements). The vowels of French mothers were more nearly equal than the vowels of English mothers, as expected. But when compared to the patterns of the children, the vowels of French mothers were roughly the same length as their children's vowels, while the vowels of English mothers differed significantly from their children's vowels in term of duration. The researchers concluded that by the age of four French children seem to have acquired aspects of the rythmical pattern of their native language, such as the duration of vowels, while English children of the same age and similar socio-economic background seem to still be statistically different from their mothers in terms of mean vowel duration.

Another very interesting study was a crosslinguistic research project by Konopczinski (2001). She investigated infant babbling patterns in several languages and regional varieties that differ in their metrical structure, such as English, European French, Canadian French, Spanish, Hungarian, and others. Most babies in her study, regardless of their native language, initially appeared to pass through a phase during which their babbling patterns are characterized by open syllables and isochrony. Konopczinsky called it "neutral phase". Afterwards there was often a stage when babies exhibited in their babbling patterns final stressing / lengthening. Only later would the infants start replacing initial isochrony with the rhythmical pattern that are specific to their ambient language. Crucially, the metrical structure of stress-timed ambient languages took longer to acquire than the metrical structure of syllable-timed ambient languages like French, due to the presence in the former of a larger variety of syllable types, the unpredictability of the stress, etc. To this point, Konopczinsky writes: "the more complex and unpredictable the rhythmical model of a language, the more difficult its acquisition" (p. 41).

Based on the research summarized above, it seems reasonable to hypothesize that L2 speakers of French, who were all native speakers of English, may have developed fairly accurate mental representations of prosodic patterns in French, which are less complex than the prosodic patterns of their native language. Expressivity of binomials has a direct relation to prosody and rhythm. For example, the knowledge that stress in French disyllabic words will never be on the first syllable and therefore, onsets will never be in perceptually salient positions, may be helpful in deciding where the contrastive sounds are preferred in French – in unstressed onsets or in stressed rhymes. This might have been helpful in deciding between *sagli-tagli* and *sagli-sagla* and choosing the latter one as a more acoustically pleasing. Also, L2 learners of French may have some implicit intuitions on most felicitous syllabic structures in French. Complex onsets make syllables longer in duration, therefore, they are avoided in languages that prefer to keep the duration of the syllables the same. This knowledge may have helped L2 learners of French successfully decide in favor of *sagli-tagli* over *sagli-stagli*, and *sagli-sagla* over *sagli-stagli*. Although these statements remain speculative, they may be worth investigating in the future. For example, evidence that would support my hypothesis could come from a replication of the present study, with advanced L2 speakers split into two groups based on their native language – a syllable-timed group or a stressed-timed group. The syllable-timed group would include subjects with native languages like Korean, Cantonese, Italian, and other languages that are conventionally categorized as syllable-timed. The stressed-timed group would include subjects with native languages like Russian, German, or Dutch. Each L2 learner would be a fluent non-native speaker of either French, or English. Thus, for both English and French test there would be three groups of participants: 1. native speakers, 2. L2 learners with a stressed-timed language as native, and 3. L2 learners with a syllable-timed language as native. The expectation would be that both groups of L2 learners would perform similarly to native speakers on the French test; however, on the English test, speakers of stressed-timed languages may exhibit a more native-like performance than the syllable-timed group. If such results are obtained in the future, that would provide more evidence for my hypothesis that the rhythm of a syllable-timed language like French is easier to learn for speakers of a variety of languages, while the rhythm of a stressed-timed language like English may be harder to learn for native speakers of syllable-timed languages. Importantly, in this kind of study the proficiency level of L2 learners has to be strictly controlled.

6.2. Predictors of native-like performance. The L2 learners who participated in this study were all proficient speakers of either French or English, however, even at advanced stages of learning non-native speakers may be statistically different from native speakers in some respects. This study made an attempt to determine which factor in learners' background may be a strong predictor of their sensitivity score on DC. This attempt was, unfortunately, unsuccessful: none of the three predictors used in this study was significantly correlated to L2 learners' scores (see Appendix D). However, it makes sense upon reflection. Expressive, playful, and poetic language, unlike referential language, is not something that L2 learners in general have a lot of experience with. Experience with playful language patterns in L2 may come through the exposure to nursery rhymes, poetry, songs, and other activities. These activities are not particularly common in a life of a typical adult L2 learner, who usually begins living in the L2 environment later in life, and for whom the mastery of expressive linguistic functions is unlikely to be the main priority. Even extremely motivated learners may not be aware of the benefits of the expressive language and furthermore, they may not know what strategies are helpful in developing a good sense for “what sounds right” in their L2. Therefore, the sensitivities to the poetic and playful patterns in L2 may not be strongly associated with the years of residence, frequency of use, and other typical predictors for the L2 performance.

However, there are other factors that I suggest to examine in the future studies. One potential factor of interest is the phonological memory of L2 learners. Individual differences among L2 learners, such as their ability to remember rhythmical patterns or playful sound alternations, may be another important piece of the puzzle that could shed light on how native-like intuitions on expressive linguistic patterns develop. In the future studies individual differences in phonological memory should be explored as a potential predictor.

Ellis (1996) argued convincingly that phonological short-term memory is crucial in learning of a second language. First, Ellis’ assumption is that language learning entails learning of sequences. Thus, acquisition of vocabulary involves identification of phonemes and their sequential probabilities in a language. Acquisition of discourse is linked to learning of sequences of particular words in collocations and phrases. Acquisition of grammar, such as learning grammatical word classes, is based on the automatic and implicit analysis of word’s sequential position in relation to other words in collocation and phrases, stored in the learner’s memory. Ellis’s model is an exemplarbased statistical one. Through exposure, learners gradually acquire language by storing in memory sequences of sounds and words and abstracting regularities from them. An impressive number of relevant studies that were summarized in Ellis' (1996) work lead to the conclusion that "ability to learn phonological sequences is at the core of vocabulary learning, idiom learning and the acquisition of grammar" (p. 101).

Another important point in Ellis' article is the argument that individual differences in phonological short term memory predict various aspects of language acquisition. This last statement seems to be relevant for both first and second language acquisition. Of course, in order to develop a large stock of exemplars, learners need a lot of input. This input, in case of expressive language, may be sufficient for native speakers, but not sufficient for late L2 learners, whose focus, as I have argued, may not be on expressive language per se. With this relatively scarce exposure, L2 learners' representations of expressive patterns may be less developed than those of native speakers; however, good phonological memory may help the build-up of native-like intuitions even with insufficient input. Accordingly, since the role of the phonological memory may be critical for language acquisition in general and for acquisition of collocations in particular, it would be interesting to explore this factor as a potential predictor of native-likeness. In particular, phonological short-term memory could be measured in respondents in various groups – native speakers, beginners, intermediate and advanced. Thus, the present study could be replicated with the purpose of investigating if phonological memory predicts native-like performance and if proficiency interacts with phonological memory.

Chapter 7: Conclusion

With respect to the objectives set for the present study, my most important goal was to test speakers' sensitivities to the putative constraints, which I subdivided into Directionality category and Correspondence category. This was accomplished, using nonce words as stimuli. Native speakers of English were the most "sensitive" group in the present study, as they showed strong preferences for three Directionality constraints (VQ, FCN, and ICN) out of six, all in the hypothesized direction.

Several interesting results emerged from the analysis of data. First, it was observed that Vowel Quality tends to be the most consistent Directionality constraint crosslinguistically. I have argued that in case of VQ several different factors (short-before-long, unmarked-before-marked, sound symbolic values of vowels) align and predict the same order. The same situation was observed for Final Consonant Number, which ended up being the second strongest Directionality constraint crosslinguistically. Future investigations have yet to determine why high means for FCN are coupled with large standard deviations.

For all the other Directionality Constraints, speakers' sensitivities tend to be less clear and vary depending on the language. A very interesting and complex situation was observed for Initial and Final Sonority. A hypothesis that I have proposed is that English and French tend to have opposite intuitions on the directionality for these two constraints, IS and FS. This hypothesis has to be confirmed with tests involving larger samples. I have tentatively explained the French pattern with the unmarked-before-marked bias, while English preferences may be based on the need to emphasize perceptual salience of sonorous consonants.

Based on the results of the present study, I have also argued that maximal changes in vocalic quality, namely in height and / or advancement, seem to be preferred to changes in nasality or phonological length of the stressed nuclei. I have speculated that maximal changes in vocalic quality may appear more expressive to speakers, which corroborates the proposal by Minkova's (2002) on the constraint INTEREST, favoring maximal perceptual distance between the base and the reduplicant.

With respect to Correspondence Constraints, it was observed that Minkova's (2002) hierarchy IDENT-BR(μ) >> *Pl/Lab was respected by both native English and French speakers. Thus, speakers of both languages find moraic discrepancies between the two constituents acoustically displeasing, with the consequence that the violation of IDENT-BR(μ) seems to be worse than the violation of constraint against labial vowels.

The study has also provided evidence for the relative strength of the putative constraints RHYME and ALLITERATE. Native English speakers tended to strongly prefer rhyming patterns over ablaut alliterating patterns, which I have tentatively explained by the decreased productivity of ablaut alliteration in English. An opposite trend was observed in French native speakers, although this result may be only applicable to disyllabic words, and has yet to be confirmed with monosyllabic words. It was also observed that the presence of a complex onset in rhyming patterns decreases their "likability", although less for English native speakers than for French native speakers.

Finally, I have found that the intuitions of learners of French on Correspondence Constraints were closer to those of native speakers than the intuitions of learners of English. I hypothesized that this may be linked to the claim that the French metrical system is somewhat easier to acquire than the English metrical system, although this statement remains speculative.

Generally, in the present study speakers applied the same intuitions on directionality in conjoined and in reduplicative conditions. This was, to my knowledge, tested for the first time. This result is not particularly surprising; since an important aspect of binomials is their phonological shape, it could be expected that speakers would use these constraints even in the conjoined condition, provided that stronger constraints on semantics and frequency are either not active or not relevant.

On a final note, even though this study did not answer all the questions one could ask about binomials and their acquisition by L2 learners, it provided a few new insights into the problem of their phonology. The crucial assumption that this investigation adopted from the inception is that binomials, both reduplicative and conjoined, tend to have expressive phonological patterns and that speakers may exhibit sensitivities to them. Two kinds of constraints - Directionality and Correspondence - seem to underlie creative processes (in reduplicative binomials) and sequencing processes (in both reduplicative and conjoined binomials). It is largely because of their phonology that binomials may be perceived as expressive; their “right-soundingness” (to use Birdsong’s term) being an important piece of the puzzle of their productivity and memorability. I hope that future investigations will shed more light on what and why “sounds right” for speakers of various languages with respect to expressive linguistic structures, instantiated *inter alia* by binomials.

Appendices

Appendix A

The complete list of experimental items for the English test

Initial Sonority:

1. loogle-boogle	boogle-loogle
2. verty-lerty	lerty-verty
3. horkit-norkit	norkit-horkit
4. deefel-heefel	heefel-deefel
5. lomick-gomick	gomick-lomick
6. neaster and heaster	heaster and neaster
7. lanties and vanties	vanties and lanties
8. tesker and resker	resker and tesker
9. yoglits and toglits	toglits and yoglits
10. biscow and wiscow	wiscow and biscow

Final Sonority:

11. bickesh-bickell	bickell-bickesh
12. restell-resteg	resteg-restell
13. lishooc-lishoon	lishoon-lishooc
14. rebam-rebat	rebat-rebam
15. miscott-miscon	miscon-miscott
16. redool and redoob	redoob and redool
17. pichoog and pichoon	pichoon and pichoog
18. hestam and hestad	hestad and hestam
19. steloat and steloam	steloam and steloat

20. tefoil and tefoig	tefoig and tefoil

Vowel Quality:

21. lisket-lasket	lasket-lisket
22. bockel-beckel	beckel-bockel
23. clazzip-clizzip	clizzip-clazzip
24. deckel-dockel	dockel-deckel
25. revid-revad	revad-revid
26. stockel and steckel	steckel and stockel
27. sladvin and slidvin	slidvin and sladvin
28. bepleck and beplock	beplock and bepleck
29. rigster and ragster	ragster and rigster
30. losky and lesky	lesky and losky

Vowel Length:

31. lister-leaster	leaster-lister
32. poolster-pullster	pullster-poolster
33. cleesty-clisty	clisty-cleesty
34. bullgor-boolgor	boolgor-bullgor
35. risty-reasty	reasty-risty
36. spoolky and spullky	spullky and spoolky
37. pleefter and plifter	plifter and pleefter
38. fullsy and foolsy	foolsy and fullsy
39. fibster and feabster	feabster and fibster
40. befoolp and befulp	befulp and befoolp

Initial Consonant Number:

41. kizzy-krizzy	krizzy-kizzy
42. sponer-soner	soner-sponer
43. guskin-gluskin	gluskin-guskin
44. crooset-cooset	cooset-crooset
45. feckin-freckin	freckin-feckin
46. spetty and setty	setty and spetty
47. siggle and stiggle	stiggle and siggle
48. plenster and penster	penster and plenster
49. beetow and breetow	breetow and beetow
50. plibster and pibster	pibster and plibster

Final Consonant Number:

51. seroap-seroapt	seroapt-seroap
52. repooct-repooc	repooc-repooct
53. beroap-beroapt	beroapt-beroap
54. fedoopt-fedoop	fedoop-fedoopt
55. revec-revect	revect-revec
56. rizept and rizep	rizep and rizept
57. boteec and boteect	boteect and boteec
58. deript and derip	derip and deript
59. resteac and resteact	resteact and resteac
60. linooct and linooc	linooc and linooct

Ident-BR (µ) vs. *Pl/Lab:

61. filky-fealky	filky-fulky
62. bilner-bullner	bilner-bealner

63. liknep-leeknep	liknep-looknep
64. nicket-nooket	nicket-neaket
65. berick-bereek	berick-berook
66. vicker and voocker	vicker and veecker
67. cabick and cabeek	cabick and cabook
68. shicket and shucket	shicket and sheecket
69. filger and feelger	filger and fulger
70. dipler and doopler	dipler and deepler

<u>Rhyming vs. Ablaut:</u>

71. fiply-faply	fipli-biply
72. feckil-deckil	feckil-fockil
73. sipret-sapret	sipret-dipret
74. serish-derish	serish-sorish
75. siglow-saglow	siglow-kiglow
76. feblic and foblic	feblic and keblic
77. sitlen and pitlen	sitlen and satlen
78. fettip and fottip	fettip and bettip
79. sipoth and bipoth	sipoth and sapoth
80. fesky and fosky	fesky and tesky

<u>Complex Onset Rhyming vs. Ablaut:</u>

81. kiply-kriply	kiply-kaply
82. teckil-tockil	teckil-treckil
83. bipret-blipret	bipret-bapret
84. kerish-korish	kerish-klerish
85. tiglow-taglow	tiglow-triglow

86. deblic and dreblic	deblic and doblic
87. ditlen and datlen	ditlen and dritlen
88. kettip and krettip	kettip and kottip
89. tipoth and tapoth	tipoth and tripoth
90. gesky and glesky	gesky and gosky

Rhyming vs. Complex Onset Rhyming:

91. siply-tiply	siply-sliply
92. seckil-steckil	seckil-beckil
93. fipret-tipret	fipret-flipret
94. ferish-flerish	ferish-terish
95. figlow-fliglow	figlow-biglow
96. feblic and teblic	feblic and fleblic
97. fitlen and fritlen	fitlen and kitlen
98. settip and gettip	settip and slettip
99. fipoth and flipoth	fipoth and dipoth
100. sesky and kesky	sesky and slesky

Appendix B

The complete list of experimental items for the French test

Initial Sonority:

1. noupet-goupet	goupet-noupet
2. taguet-laguet	laguet-taguet
3. rupotte-tupotte	tupotte-rupotte
4. guinotte-rinotte	rinotte-guinotte
5. madet-gadet	gadet-madet
6. ni pamique ni lamique	ni lamique ni pamique
7. ni rouvet ni chouvet	ni chouvet ni rouvet
8. ni divotte ni livotte	ni livotte ni divotte
9. ni mavaipe ni gavaipe	ni gavaipe ni mavaipe
10. ni canaide ni ranaide	ni ranaide ni canaide

Final Sonority:

11. cazille-cazibe	cazibe-cazille
12. talaique-talaime	talaime-talaique
13. rinoule-rinoupe	rinoupe-rinoule
14. chipague-chipane	chipane-chipague
15. ratalle-ratafe	ratafe-ratalle
16. ni davaisse ni davaile	ni davaile ni davaisse
17. ni cadaille ni cadape	ni cadape ni cadaille
18. ni tipame ni tipague	ni tipague ni tipame
19. ni rouzaille ni rouzape	ni rouzape ni rouzaille

20. ni coubade ni coubaille	ni coubaille ni coubade

Vowel Nasality:

21. goudinte-goudette	goudette-goudinte
22. tida-tidan	tidan-tida
23. chavinte-chavette	chavette-chavinte
24. gonais-gonin	gonin-gonais
25. cralonte-cralotte	cralotte-cralonte
26. ni vulpotte ni vulponte	ni vulponte ni vulpotte
27. ni davais ni davain	ni davain ni davais
28. ni stola ni stolan	ni stolan ni stola
29. ni flitan ni flita	ni flita ni flitan
30. ni traplette ni traplinte	ni traplinte ni traplette

Vowel Quality:

31. calite-calate	calate-calite
32. raniette-raniotte	raniotte-raniette
33. padaque-padique	padique-padaque
34. loubette-loubotte	loubotte-loubette
35. clatife-clatafe	clatafe-clatife
36. ni raffotte ni raffette	ni raffette ni raffotte
37. ni trapale ni trapile	ni trapile ni trapale
38. ni plamette ni plamotte	ni plamotte ni plamette
39. ni fuglite ni fuglate	ni fuglate ni fuglite
40. ni sapoque ni sapaique	ni sapaique ni sapoque

Initial Consonant Number:

41. codelle-crodelle	crodelle-codelle
42. brezouille-bezouille	bezouille-brezouille
43. fupon-flupon	flupon-fupon
44. truguet-tuguet	tuguet-truguet
45. salaine-stalaine	stalaine-salaine
46. ni clavrer ni cavrer	ni cavrer ni clavrer
47. ni tivaipe ni trivaipe	ni trivaipe ni tivaipe
48. ni cloudin ni coudin	ni coudin ni cloudin
49. ni fomaige ni flomaige	ni flomaige ni fomaige
50. ni plirot ni pirot	ni pirot ni plirot

Final Consonant Number:

51. bicafe-bicafre	bicafre-bicafe
52. ridacte-ridac	ridac-ridacte
53. tiboufe-tiboufre	tiboufre-tiboufe
54. ganoucte-ganouc	ganouc-ganoucte
55. padafe-padafre	padafre-padafe
56. ni ladacte ni ladac	ni ladac ni ladacte
57. ni dalaife ni dalaifre	ni dalaifre ni dalaife
58. ni gouvacte ni gouvac	ni gouvac ni gouvacte
59. ni tilafe ni tilafre	ni tilafre ni tilafe
60. ni capaicte ni capaic	ni capaic ni capaicte

Ident-BR (μ) vs. *Pl/Lab:

61. glavette-glavinte	glavette-glavotte
62. croudette-croudotte	croudette-croudinte
63. plarette-plarinte	plarette-plarotte
64. churette-churotte	churette-churinte
65. gautrette-gautrinte	gautrette-gautrotte
66. ni soitette ni soitinte	ni soitette ni soitotte
67. ni bimette ni bimotte	ni bimette ni biminte
68. ni vapette ni vapinte	ni vapette ni vapotte
69. ni maflette ni maflotte	ni maflette ni maflinte
70. ni lutette ni lutinte	ni lutette ni lutotte

Rhyming vs. Ablaut:

71. sabi-saba	sabi-cabi
72. fudette-budette	fudette-fudotte
73. sagli-sagla	sagli-dagli
74. saubette-daubette	saubette-saubotte
75. chadi-chada	chadi-tadi
76. ni fupette ni fupotte	ni fupette ni cupette
77. ni sougui ni sougua	ni sougui ni dougui
78. ni faglette ni faglotte	ni faglette ni taglette
79. ni faprige ni faprage	ni faprige ni gaprige
80. ni fontec ni fontoc	ni fontec ni pontec

Complex Onset Rhyming vs. Ablaut:

81. dabi-daba	dabi-drabi
82. cudette-cludette	cudette-cudotte
83. pagli-pagla	pagli-pragli
84. paubette-plaubette	paubette-paubotte
85. padi-pada	padi-pladi
86. ni tupette ni trupette	ni tupette ni tupotte
87. ni cougui ni cougua	ni cougui ni crougui
88. ni daglette ni draglette	ni daglette ni daglotte
89. ni baprige ni baprage	ni baprige ni blaprige
90. ni gontec ni grontec	ni gontec ni gontoc

Rhyming vs. Complex Onset Rhyming:

91. fabi-gabi	fabi-flabi
92. sudette-studette	sudette-pudette
93. fagli-tagli	fagli-fragli
94. faubette-flaubette	faubette-gaubette
95. sadi-gadi	sadi-sladi
96. ni supette ni slupette	ni supette ni gupette
97. ni fougui ni pougui	ni fougui ni flougui
98. ni saglette ni staglette	ni saglette ni paglette
99. ni saprige ni caprige	ni saprige ni claprige
100. ni sontec ni stontec	ni sontec ni bontec

Appendix C

Verbal Consent Form

Consent to Participate in Research

Identification of Investigator and Purpose of Study

You are invited to participate in a research study, entitled "Native and Non-Native Intuitions on the Word Order in Irreversible Binomial Locutions in French and English". The study is being conducted by Dr. David Birdsong and the Department of French and Italian of the University of Texas at Austin (201 W 21ST STREET STOP B7600, HRH 2.114A, AUSTIN, TX 78712, tel. 512-471-5531).
The purpose of this research study is to examine the intuitions of native and non-native speakers on phonological naturalness in binomial locutions. You are free to contact the investigator at the above address and phone number to discuss the study. You must be at least 18 years old to participate.

If you agree to participate:

- The experiment will take approximately 60 minutes of your time.
- You will listen to a recording and complete a rating task with nonsensical words.
- You will be given a compensation of 15 USD.

Risks/Benefits/Confidentiality of Data

There are **no known risks.** There will be no costs for participating, nor will you benefit from participating. Your name and email address will be kept during the data collection phase for tracking purposes only. A limited number of research team members will have access to the data during data collection. Identifying information will be stripped from the final data set.

If it becomes necessary for the Institutional Review Board to review the study records you will be protected to the extent permitted by law. Your research records will not be released without your consent unless required by law or a court order. The data resulting from your participation may be made available to other researchers in the future for research purposes not detailed within this consent form. In these cases, the data will contain no identifying information that could associate it with you, or with your participation in any study.

Participation or Withdrawal

Your participation in this study is voluntary. You may decline to answer any question and you have the right to withdraw from participation at any time. Withdrawal will not affect your relationship with The University of Texas in anyway. If you do not want to participate either simply stop participating or close the browser window.

Contacts

If you have any questions about the study or need to update your email address contact the researcher **Viola Green** at **415-846-0902** or send an email to violamakarova@hotmail.com. This study has been processed by The University of Texas at Austin Institutional Review Board and the study number is **2015-05-0005.**

Questions about your rights as a research participant.
If you have questions about your rights or are dissatisfied at any time with any part of this study, you can contact, anonymously if you wish, the Office of Research Support by phone at (512) 471-8871 or email at orsc@uts.cc.utexas.edu.

If you agree to participate, please tell me verbally. Thank you.

Appendix D

Summary of the Regression Analysis

A regression analysis of the data was performed to examine the potential predictors of the performance for the group of non-native English speakers.

All L2 learners in the study filled out three sections of the Bilingual Language Profile (BLP): Language History, Language Use, and Language Attitudes. These three variables were investigated as possible predictors of the mean sensitivity scores for L2 learners. Since I ended up having a rather small number of participants, conducting a multiple regression model was determined to be inappropriate. Instead, simple regressions were conducted.

The choice of the dependent variable was complicated by the fact that subjects' sensitivity was measured on several putative constraints, and therefore, the scores for several constraints could be used as a dependent variable. Constraints, for which mean ratings for native English speakers were not significantly different from the threshold of indifference, were excluded. This leaves three constraints – VQ, FCN, and ICN. When comparing the performance of 18 non-native English speakers to the performance of 16 native English speakers, I have noticed that their performance was similar on VQ and FCN, because for these constraints the mean ratings were significantly different from the level of indifference for both groups – native and non-native speakers. However, in addition to FCN and VQ, native English group had the mean rating scores that were significantly different from 3.5 on ICN, while non-native speakers did not. Therefore, ICN was selected to be the dependent variable, since it was the only constraint out of three for which native and non-native speakers differed in sensitivity. I hypothesized that the second best candidate for the dependent variable would be the average of the three strongest constraints - FCN, ICN, and VQ.

Unfortunately, none of the predictors was correlated to the score on ICN (the p-values were $> .05$ for all the predictors). I repeated the same simple regression tests, but with a different dependent variable, an average of the three strongest constraints. The same results were obtained – the three predictors that were chosen appeared to be unrelated to the sensitivity scores.

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